April 1982

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sinclair user

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Issue No 1



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Sinclair User is published monthly by ECC Publications Ltd. It is not in anyway connected with Sinclair Research Ltd.

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01-359 7481

If you would like to contribute to Sinclair User, please send typed (or beautifully-handwritten) articles or programs to—
Sinclair User
ECC Publications,
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We will pay £10 for each program printed and £50 for each article which should be approximately 1,000 words long.

ISSN No. 0262-5458

Printed and typeset by
Bournehall Press Ltd,
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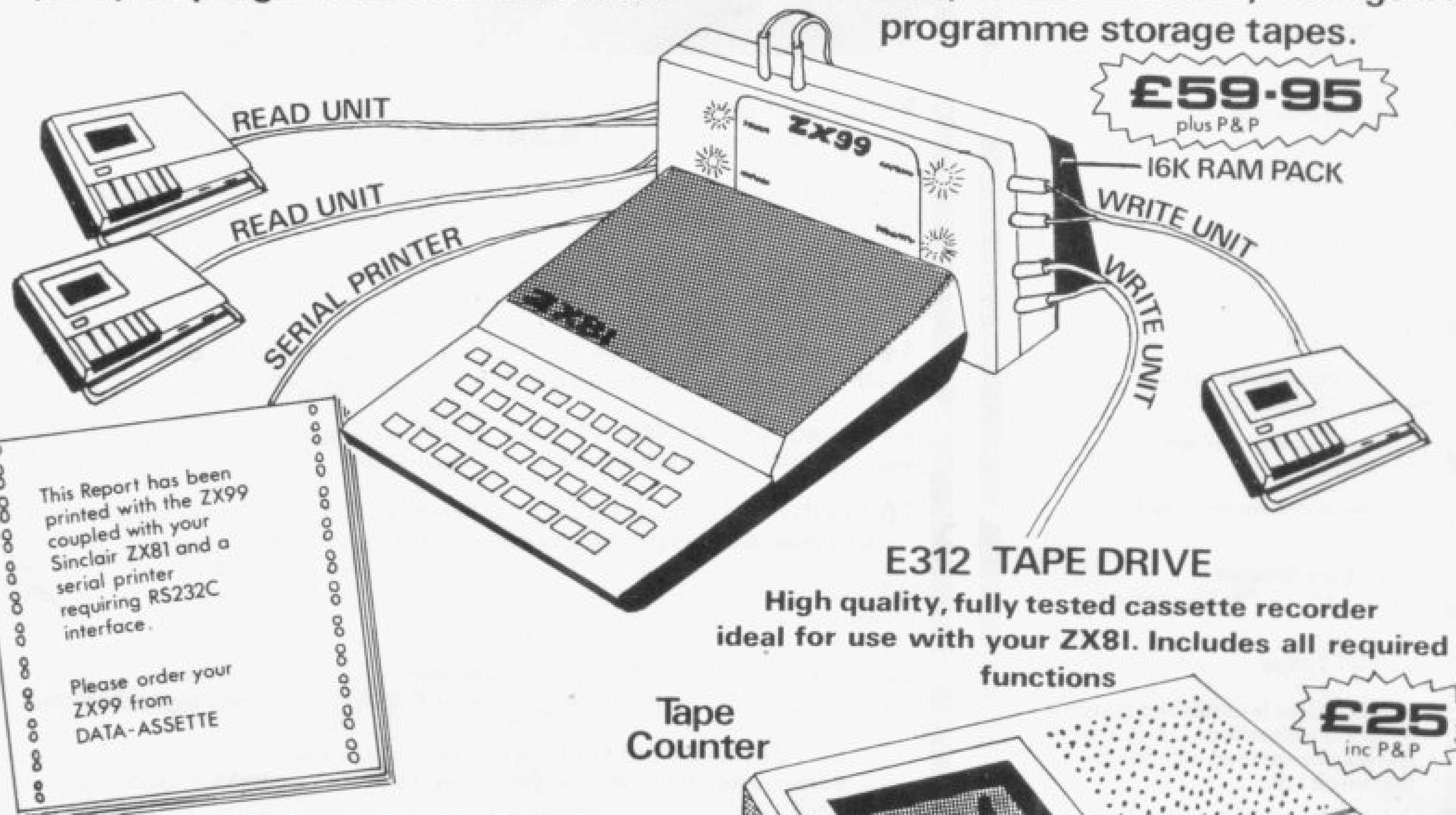
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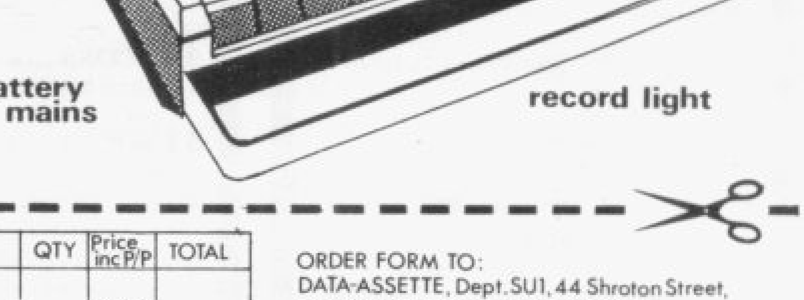
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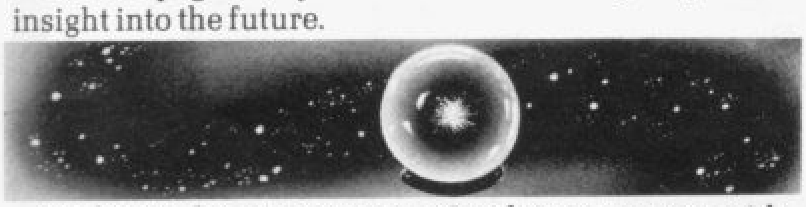


Let's begin with a look ahead

WELCOME to the first issue of *Sinclair User*, the independent magazine which aims to help you make the most of your machine. Each month we plan to provide you with as much fun and information as possible. We will always print a good selection of programs, plus news of new products and in-depth reviews of established hardware and software.

There will also be general interest features and applications stories about how other people are involved with Sinclair and ZX machines.

On this page every month we intend to give you an insight into the future.



To begin, let us imagine a Sinclair computer with built-in screen, colour, discs and extended Basic to rival the BBC computer at around £200. Or even a cheap disc system and a Prestel adaptor for the ZX-81.

Rumours abound but the one man who could answer most of those possibilities for certain, Clive Sinclair, is content for the moment to keep us guessing.

First, the Prestel adaptor, which could breathe new life into the flagging British Telecom system, if the 200,000 or so ZX owners around could be persuaded to buy one. BT is reported reliably to be considering at least 20 applications for its £1,000 prize announced three months ago for a workable ZX-81 adaptor. The winner or winners of the competition are expected to be announced in late April. [See page 61 for the full story].

The adaptor makes exciting news for Sinclair users because it would mean they could communicate directly with each other—directly via Prestel, that is. I shudder to think what that could mean in terms of software piracy.

Commercial suppliers may find they need to sell only one program to see it instantly distributed—free —throughout the country.

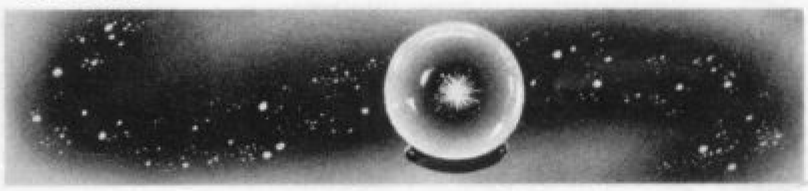
Rumours of a mass storage device, possibly for the ZX-81, to be produced by Sinclair Research have been circulating for some time. Surely it cannot be a coincidence that he has a research laboratory near to that of IBM at Winchester.

The main rumour is that Sinclair is developing a mini-disc, selling for around £100, and that the development can be expected towards the end of this year and may even be announced shortly. Sinclair said something about discs—across a crowded room—in January. The only problem is that Sinclair seems to have a shopping list of products which he would dearly like to make—provided that the technology is available to enable him to do so at the proper price and we do not know how far up that list ZX-81 discs are.

Again, it would be marvellous news for ZX users. It is just that it seems too good to be true. Imagine, no more slaving over a hot and possibly unreliable tape recorder, or going to make a cup of tea while the 16K program loads-up. You could make use of that huge address/telephone/stamp collection program you wrote because you could probably access the information in a few seconds, instead of the many minutes it takes at present.

Finally, there is the vexed question of the ZX-82. Will he or will he not produce it? My guess, for what it is worth, is that he will not, at least not in 1982, although I would be delighted, in thst case, to be proved wrong.

Speculation about the ZX-81 began almost as soon as the ZX-81 appeared and it seemed that the 80 in ZX-80 referred not to the Z-80 processor it used, as everyone had assumed, but to the year of its launch. A ZX-80 in 1980, a ZX-81 in 1981. What could be more helpful than a ZX-82?



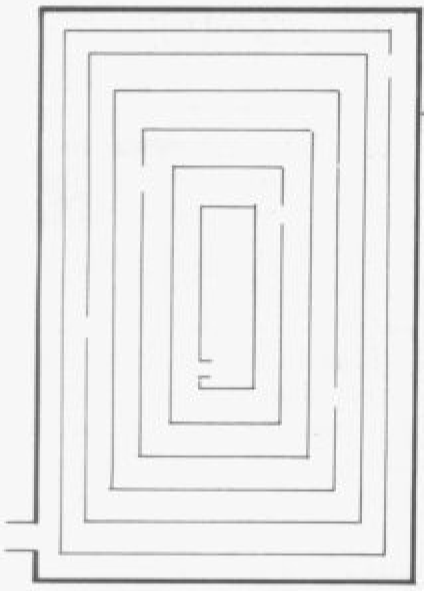
Speculation was fuelled further by Clive Sinclair's reaction to the BBC choice of microcomputer last year. He is reported to have said he could have met the specification for around half the price of the model chosen. Sinclair seemed, perhaps understandably, annoyed that the BBC had failed to select the most obvious choice for a beginner's machine, the ZX-81. The question arose at to whether he would meet the challenge and produce a competing product.

Sinclair said last year that he foresaw a convergence of his computer and flat-screen technologies in 1982. More recently he suggested that it would be a later development—"perhaps 1983-84". He may, of course, have been referring to the negotiations with ICL to produce a small computer terminal incorporating the flat screen and using Sinclair Basic.

What now seems certain, especially in view of his recent licensing agreement with Timex in North America and his tie-up with ICL is that he will stay in the computer field. That being the case, there is a tantalising gap in the market between the ZX-81 and the next product up. If you wanted to upgrade where would you go?

Each month Sinclair User aims to introduce new products

What's new in the marketplace



Entering the 3D Labyrinth

THIS GAME is in full 3D and presents you with an ever-changing view of a corridor along which you must travel to get out of the maze. Written in machine code, it gives a quick reaction to the input of a direction and gives help if you are lost.

The maze changes with every new game and an overall view of it is given for a short time before asking for the input of the first move. The maze size can be selected beforehand to give varying levels of difficulty.

The program costs £5.95 and will fit in 14K, so the 16K pack will be required to use it. Axis, 71 Brookfield Avenue, Loughborough, Leics LE11 3LN markets the program.

Possible replacement for Basic?

A NEW language designed to replace Basic for writing programs. It is designed to simplify the writing of word games, multiple-choice tests and quizzes. It is also recommended for writing computer-aided learning packages for schools and colleges. The original Mickie was developed by the late Dr Christopher Evans at the National Physical Laboratory and the NPL still considers it important enough to reserve it as a trademark.

The Mickie language also has single-key commands and is written in machine code for a fast response. A manual of examples is provided with the language. The cost is £15 approximately for manual, machine code language tape, and examples tape.

Mickie for the ZX-81 can be obtained from Abies Informatics, 10 Barley Mow Passage, London W4 4PH.

Glorious games all in 1K

ALL THE programs on the two cassettes will run on the basic 1K ZX-81 without the need for extra memory. The first tape costs only £4 and contains four games —*Laser Blast, Alien Crawler, Ghost Hunt* and *Torpedo.*

It also contains four programs to help your finances balance. *Bank Budget* will keep a running bank statement for you on your regular payments and check your ZX-81 against the bank's IBM statement for any computer errors. *Budget* will tell you how much you are worth after you deduct your regular payments. Can you afford that new car? *Car Log* is two programs, one for the dreaded metric litres and one for imperial gallons.

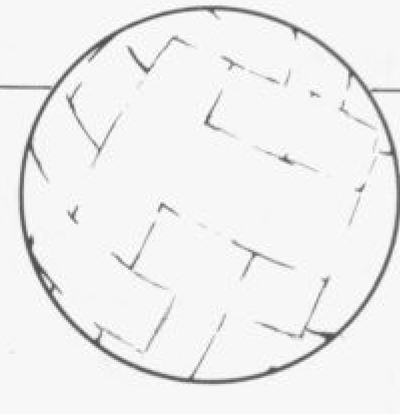
If you want only the finance programs, pay £2.50 for cassette number two. A copy of either tape is available from Zedex, 2 Stone Castle Cottages, Maidstone Road, Five Oak Green, Kent TN12 6SD.

Monopoly makes its mark

BRAND NEW on the market is ZX-81 *Monopoly.* Up to six players can compete and the ZX-81 functions as board, rule book, umpire, dice-thrower, accountant and rent collector. Players are guided through the game by a menu indicating who goes with an update on assets.

As the game is likely to become a marathon a SAVE routine is included. To save a game the QUIT option is used as an interrupt and is followed by a winner so far report. The game can then be saved on tape for future use.

Monopoly costs £8 including VAT and postage and is available from Work Force, 140 Wilsden Avenue, Luton, Beds.



Putting the ball in the net

A MODERN, up-to-date game with four divisions, promotion and relegation struggles and several levels of play. After selecting your team and transferring the players you do not like or cannot afford, see what your game results are. You can play as many seasons as you like, but watch for those injuries.

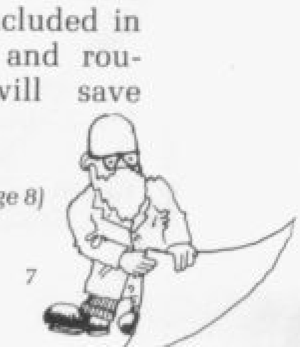
You can save any game on to cassette and continue when you next have spare time. A managerial rating will tell you how good or bad you are. The program obviously requires 16K of RAM and is available for both the ZX-80 and the ZX-81. The ZX-80, however, must be equipped with an 8K ROM.

The cost is £9.95 from Addictive Games, 267B Conniburrow Boulevard, Milton Keynes MK14 7AF.

Helps stop re-inventing the wheel

THIS PROGRAM is for the programmer who spends most of his time re-inventing the wheel in his programs. It provides routines which can be included in most programs and routines which will save

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the programmer work. The list includes a RENUMBER which will also change GOTOs and GOSUBs, LOADing SAVEing and RUNning machine code, INSPECT-COPY and alter—when COPYd into RAM—ZX-81 ROM routines, REPLACE all lines of Basic in a given program with another.

The cost of the toolkit is £6.50. The author has also written a book on hints and tips for the ZX-81 which has been much praised; it includes more routines for data files.

The book and the toolkit can be obtained from Hewson Consultants, 7 Grahame Close, Blewbury, Oxon OX11 9QE.

Looking through a window

A FASCINATING new language, christened Window Language by its author, is for writing large display programs for shop windows, the like of which has never been seen previously. The screen can be divided into sections, which can be scrolled independently up or to the right, in large or small characters. It can also reverse video any chosen window without affecting the rest of the message. The rolling, changing display can be long, as it requires the 16K RAM pack to run it.

The program is obtainable from Campbell Systems, 15 Rous Road, Buckhurst Hill, Essex 1G9 6BL for £7 but overseas orders should include sufficient for an air mail package.



Cheap but also very cheerful

THIS FIRM provides some of the cheapest software listing available, ranging from 55-70 pence. They are all 1K games and include *Alien Chase* and *Navarone*—shooting games. *Phototon* fire scores hits as space ships cross your star field view of the universe. *Fireman's Rescue* is a game in which you bounce people from a fire into a waiting ambulance. *Asteroid Belt* means that you must avoid the rocks hurtling at you to survive. There are also some 16K pack games available on cassette from £2 to £4.

Heltaskelta Software is at 48 Cranfield Road, London SE4 1UG.

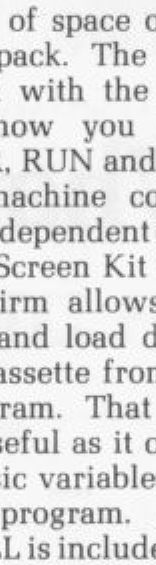
Machine code monitor

THE PROGRAM allows you to write machine code, SAVE and LOAD it at double speed. It provides breakpoints in your routines, so that you can find the results so far as a check as to why your program crashes. The monitor takes up 3½K of space on a 16K RAM pack. The 32-page manual with the cassette will show you how to ENTER, RUN and DEBUG your machine code routines independent of Basic.

The Screen Kit 1 by the same firm allows you to create and load data files from cassette from within a program. That can be very useful as it can swap the Basic variables for the same program. A new SCROLL is included which will move the screen, up, down, right or left.

The ZX-MC with manual costs £6.50 and the Screen Kit 1 £4.95.

Both cassettes are available from Picturesque, 6 Corkscrew Hill, West Wickham, Kent BR4 9BB.



Making layouts simpler

SIMPLIFIES the drawing of program layouts for games or teaching programs. It is menu-driven, which means that you have a multiple-choice question to answer for the things you want to do. The characters are inserted on the screen by moving a cursor to the place on the screen where you want the graphic and pressing key 9. That then draws a line which will follow the cursor until key 0 is pressed. That puts the cursor back into the rub-out mode.

Text and graphics can be inserted anywhere on the screen and up to 12 screens full can be stored in one 16K RAM pack.

The entire program, including all the screens, can be saved on cassette for running later. The cost is £6.95 for the cassette and manual, £8.95 for boxed de-luxe sets.

Video Sketch is available from Video Software, Stone Lane, Kinver, Stourbridge, W. Midlands DY7 6EQ.

Aids you on your adventure

GAMEL is not an adventure program but a program which allows you to write your adventure programs. The game is on cassette with an instruction book explaining how you can write programs in hours rather than weeks. The ZX-81 can now be programmed to find a gold treasure within a pyramid, avoiding the long-lost ghosts of his servants and the built-in traps which you have devised. Or, if you fancy discovering minerals on an alien planet infested with monsters and rivals, for rubium, obniberite or titanium, the choice is yours.

Gamel 81 is available from Control Technology, 39 Glouster Road, Gee Cross, Hyde, Cheshire Sk14 5JG.

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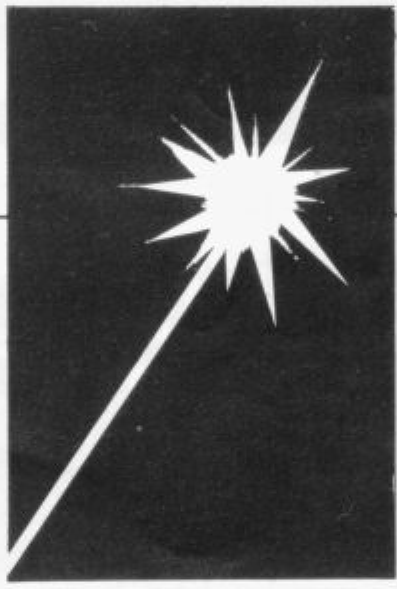




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Speedy game of Defender

ENTIRELY in machine code and providing a very fast game if you can survive. The background moves from right to left, giving the impression of movement over varying terrain. The object of the flight of your defender spaceship is to destroy the invaders from the right. They can fire at you, drop bombs on you or crash into you. All you have to defend yourself is your laser cannon, manoeuvrability up and down and the speed at which you attack the enemy.



Adjustments can be made to the program if your television set cannot keep up with such a fast game as is included in the instructions. If you have bought a sound board from the same company, you can enjoy all rushes of the wind, explosions and crashes, as they are already included in the the program.

Defender is available from Quicksilva, 95 Upper Brownhill Road, Maybush, Southampton.

Chess on several levels

AVAILABLE in two versions. The original, with levels 1-6 which uses standard notation for moves, presents illegal move if any other is entered and allows you to play black or white. The full screen is used and the machine code games give a very fast response.

ZXchess II has seven levels, one of which, *Lightning chess*, will respond faster in end moves and opening book moves. The game, however, can recommend your best move and recognise stalemate.

Both games will allow you to set up your own board pieces and start from there, thus allowing you to solve newspaper problems without waiting a week for the results. ZXchess II also allows you to copy the board on to a Sinclair printer or to store a game on to cassette.

Artic Computing, author of ZXchess, can be reached at 396 James Reckitt Avenue, Hull, North Humberside. ZXchess is £8 and ZXchess II £14.

All prices in this review have been rounded-up to include VAT and postage where possible.

Add-ons to make your computing more fun

As more and more people buy ZX-81s, more and more companies are bringing out add-on products. Each month we will look briefly at what has arrived recently on the market

Slow mode kit

NOW a kit for a ZX-80 which will allow you to have a constant static screen when used with the 8K ROM. Compshop will not assemble kits or attach them to a ZX-80. The kit is for the ZX-80 enthusiast who can use a soldering iron, as it takes care and patience to fit it inside the ZX-80 case.

It stops that annoying flicker when accepting an INPUT or entering a program from the keyboard. The top line will tend to slant to the left and the power supply may have to be changed, as the unit draws 300ma from the +5V regulator but the cost is only £15.99.

Compshop Ltd, 14 Station Road, New Barnet, Hertfordshire EN5 1QW. There are Compshops in the U.S. and the Republic of Ireland.

Aiming for real power

DATA-ASSETTE has launched the first of its hardware add-ons for the ZX-81. Called the ZX-99, the device slots into the expansion board and according to the company gives the ZX-81 real computing power.

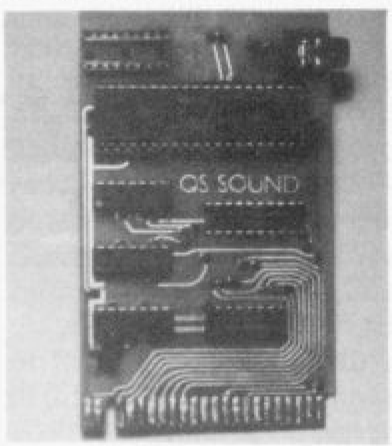
Four tape recorders can be handled at one time and business applications are now within reach.

The ZX-99 also provides an RS232C serial output interface which allows a wide range of printers to be driven.

The ZX-99 is available from Data-assette, 44 Shroton Street, London NW1.

Boards galore from Quicksilva

THIS COMPANY was one of the first to introduce a motherboard, so that other things could be connected



Part of the range.

to the ZX-80 or ZX-81 when the 16K or other memory pack was fitted. Since then, a range of goods has been produced, from 3K RAM packs at £18 to sound and programmable graphics boards. All the boards, apart from the RAM, will plug in either direct to the ZX-81 via a QS connector—a double-sided edge connector—or into the motherboard.

The sound board also has included a 16-bit port which can be used to control devices external to the ZX-81 by PEEK and POKE commands. The boards are all supplied with very clear, easy-to-understand instructions and Quicksilva provides test programs for each unit.

QS motherboard £12; QS sound board £26; QS CHRS board £26; QS RAM from £18-£35. Quicksilva is at 95 Upper Brownhill Road, Maybush, Southampton, Hampshire.

Making the proper noises

THIS UNIT will allow ZX-80 or ZX-81 owners to put any audio sounds through their TV loudspeakers. The sounds can be fed-in from a tape recorder—instructions for using the program perhaps? They can also be used to give *Space Invaders* real explosions.

The kit requires the use of a soldering iron to attach it to the ZX-81 video modulator but derives all its power from the internal +5V regulator. The kit is a metal box which fits on top of the modulator inside the ZX machines. A separate audio lead which can be plugged into a tape recorder ear socket or the output of a sound board is also provided. The audio transferred in the slow mode is unaffected by the ZX-81 computing.

The audio modulator costs £10 and is available for Compusound (U.K.), 32 Langley Close, Redditch, Worcs B98 0ET. It is called a Telesound 82.

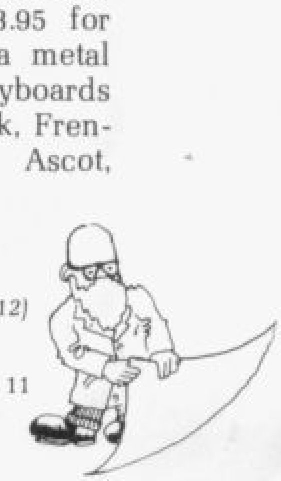
Keying out of industry

THIS PROFESSIONAL keyboard is from a manufacturer of keyboards for the computer industry generally. It consists of 46 microswitch keys with the correct stepped arrangement for a QWERTY keyboard. It requires no soldering to attach it to the ZX-81—only the opening of the ZX-81 plastic case and the insertion of the replacement leads.

It is complete with instructions. Forty keys are labelled with the Sinclair codes, leaving six spare keys for the user and the space bar unmarked. The overall dimensions are 10in. × $4\frac{1}{2}$in. × 2in.

The cost is £28.95 for the keyboard and £43.95 for the keyboard in a metal case. Computer Keyboards is at Glendale Park, Frenbank Road, Ascot, Berkshire.

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Taping-out your problems

THIS tape recorder has been designed by a manufacturer of floppy discs to eliminate the problems with LOADing and SAVEing tapes. Each tape recorder, which looks the same as any portable tape recorder, is tested and sold complete with a certification tape. The ECR81 has a long-life recording head adjusted for the correct alignment to TDK CrO2 high bias tapes.

It takes the data from a tape and passes it through a special circuit, so that tape variations cannot effect the data LOADed into the ZX-81. The output is through a DIN socket. Program names can be entered for recording on tape through a condenser microphone fitted within the tape recorder.

The ERC81 tape recorder can be obtained from The Monolith Electronics Co Ltd, 5-7 Church Street, Crewkerne, Somerset TA18 7HR.

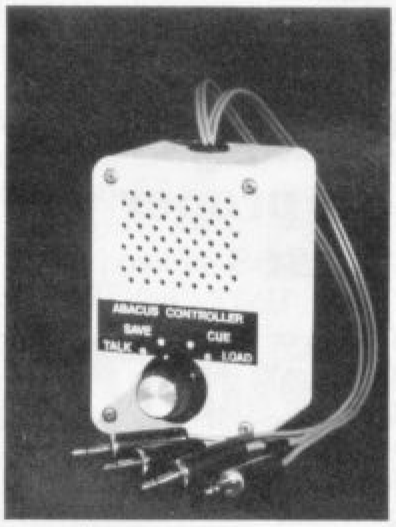
A port only for the ZX-81

A MEMORY-MAPPED port which can be PEEKed and POKEd from a Basic program located at 11,000 for the ZX-81 or 25,000 on a ZX-80. That means that it cannot be used with the 16K RAM pack on the ZX-80; the 16K RAM can be used only on the ZX-81. That port allows the user access to control printers, to light LEDs, to use joysticks. Technomatic can also supply a booklet of applications for 40 pence if you want some ideas. Demonstrated at the ZX Microfair was the use of the OUTPUT port to generate tones through an external loudspeaker. The INPUT and OUTPUT ports are mounted on a printed circuit board which plugs into the back of the ZX machines, so an extra printed circuit board will have to be used to attach the 16K RAM pack—also obtainable from the same firm.

Technomatic can be contacted at 17, Burnley Road, London NW10 1ED. The port costs £18.

One switch from Abacus

THIS BOX has one switch to control all your tape recorder functions. LOADing and SAVEing, cueing the tape up to the correct position and inserting a voice on to the tape all



Controlling your tape.

have one switch position. Cueing is done by listening to the tape via the amplifier and loudspeaker included in the unit. The same loudspeaker is used for a talk-in before the program starts.

Feedback causing hum or a high-pitched tone on recordings is eliminated by switching-off the ear connection when SAVEing. Therefore all the leads can be left plugged-in all the time.

The unit is also supplied with 70 centimetres of cable so that the tape recorder does not have to be sited next to the ZX machine.

Abacus can be contacted at 186 St. Helens Avenue, Swansea, West Glamorgan. The controller costs £12, including postage and packing.

Helping to expand up to 32K

THIS RAM pack fits on to the back of a ZX-81 to give 32KB of memory for use by the Sinclair 8K Basic. The original 16K can be expanded to 32K on the ZX-81 by altering the RAMTOP variable and giving the command NEW. After that is done there is 16K for programs and 16K for variables and data.

Audio Computers now supplies some programs for storing the screen and program in high memory—above RAMTOP. That allows you to change the screen within a program and swap programs stored in RAM. It is not possible with the programs just to swap the variables (data) to a new program.

Audio Computers is at 87 Bournemouth Park Road, Southend-on-Sea, Essex. The 32K RAM pack costs £46 for a kit and £54 ready-built.

Screwing-in a system

THE FULLER DP system consists of a keyboard unit which contains your ZX-80 or ZX-81 printed circuit board and a keyboard made up of 40 microswitches in the same layout as the Sinclair flat keyboard. The tops of the keys are stepped and have on the key-tops the same symbols as the Sinclair keyboard, covered with a clear plastic top to prevent wear.

The system can be built-up using the 16K RAM pack and a motherboard which will accept any boards which will plug into the standard 23 × 2-way edge connectors.

The power supply can be fitted inside the case and can reduce the number of cables required to connect the unit. The system requires only a screwdriver to assemble unless you have ZX-80; if that scares you, Fuller will do it for £10. The basic system, which consists of the cased keyboard, costs £32.75 as a kit or £38.75 built.

Fuller Micro Systems is at Sandfield Park East, Liverpool L12 9HP.

Aiming at 'proper' invaders

IF YOU become disinterested in *Space Invaders* looking as if they were made from Lego, you can, with this board, swap Sinclair letters and charac-

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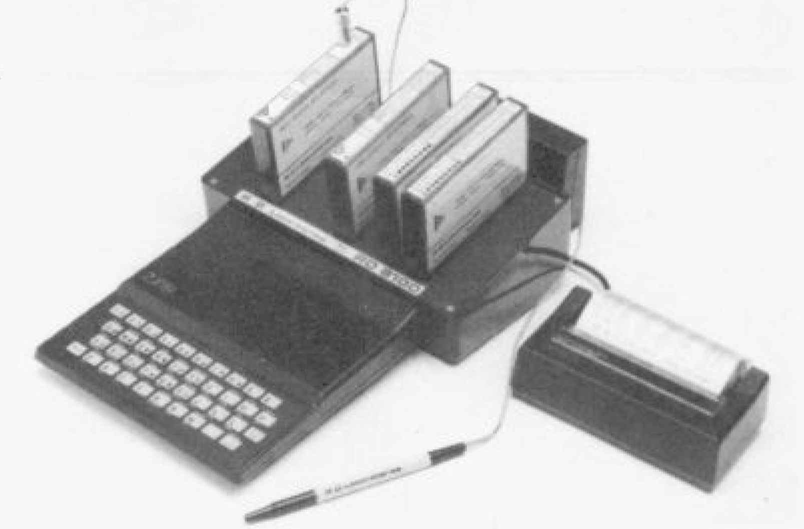
ters for proper *Space Invaders*. It fits beneath the keyboard in the ZX-81 and requires three soldered connections to the ZX-81 printed circuit board. If that worries you, send the ZX-81 and an extra £3 and it will be done for you.

There are 448 extra characters within the ROM which require no special taped program or RAM to use; a simple instruction of LET X = USR (??????) is all that is required. There is a spare socket on the unit so that graphics symbols of your choice can be used. A RAM chip—4118 or 6116—must be inserted in the socket to store all these user-defined characters.

The 4K graphics ROM and printed circuit board is available for £30.95 from dK'tronics, 23 Sussex Road, Gorleston, Gt. Yarmouth, Norfolk.

Mum's the word for facilities

THIS SYSTEM, usable on the ZX-80 or ZX-81, consists of a motherboard into which cassette case-type modules plug, giving extra facilities. The motherboard consists of a connector to plug into the ZX machine and vertical printed circuit boards on to which the modules fit. The printed circuit expansion port at the back connects to the 16K RAM pack. There are two sizes of motherboard. the Micro-mum which will take two boards and the Super-mum which will take eight boards. The unit is supplied from the ZX machine +9V line via its +5 V regulator. All the devices from light pen to analogue and digital inputs are available through PEEKing and POKEing location 15360 to 16383. The Mini-mum costs £15.80, the Super-mum £40.80. The modules cost between £23.30 and £33.30.



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fair share o



Every day Sinclair receives up to 50 pleas for help. And incredibly they are all dealt

WITH 250,000 ZX-81 sales under the belt of Sinclair Research, the technical advice department is inundated with enquiries every day, covering an ever-wider range of points.

Many people might think that Sinclair employs an entire team of experts to deal with the mounds of technical queries pouring in daily but, in reality, one person copes with them single-handed.

Now housed in the recently-acquired, plush offices of Sinclair Research in Cambridge, Ruth Bramley, with some help from her secretary, deals every day with the sometimes daunting task of replying to technical enquiries about the ZX-80 and ZX-81.

On the surface that part of the Sinclair operation appears a simple one. If you write to the Cambridge headquarters or telephone with a technical enquiry, nine times out of 10 you will be given a prompt, helpful answer.

Behind the scenes, however, it resembles organised chaos. As the only technical adviser for Sinclair, Miss Bramley has to deal with all the letters and telephone calls on the subject. On an average day she handles between 30 and 50 letters and calls.

About a year ago she was receiving something in the region of 20 to 30 letters and calls a week, which shows how much ZX-81 sales have increased in that ime.

People of every age like to know about the ZX-81, ranging from schoolchildren who have just started using the machine to middle-aged people verging on retirement who do not want to let their brains go stale, through to the elderly who find tackling some such new concept an interesting challenge.

"If children write or telephone me, I will take extra trouble to sort out their problems because, after all, they are the adults of tomorrow who will be using this technology all the more", she says.

With such a wide range of people wanting information, it is inevitable that they will make a variety of requests and need many different problems solving.

"The biggest query is undoubtedly from people asking about cassette loading and almost always it is because people are using a recorder which is not compatible", she adds.

To cope with the demand generated by that query, a standard letter has been devised which tells the user how to set the correct signal level, the correct type of jack-plug to use, how to avoid noise from mains being recorded on to the tape, and how to align the tape properly against the playback head.

With the letter is also sent a list of cassette recorders which have proved to be compatible with the ZX-81 and which produce the best results.

The process of answering written enquiries is time-consuming. It starts at the Cambridge King's Parade HQ where the letters arrive. Once opened, a small team of people



Ruth Bramley: up to 50 letters a day.

ng the lady e than her of problems

with by one woman, Ruth Bramley. Here we look at how she manages to cope



sort them into various categories. Many require a standard brochure about the computer containing details about both the hardware and applications software available and how to order goods.

Anything of a remotely technical nature goes straight to Miss Bramley. Others are sent to her equivalent in the sales, engineering, production and complaints departments.

"I like to have the letters in and out the same day, otherwise I accumulate an enormous backlog", she explains.

Most of the letters are helping people with programming problems. With programming forming part of her mathematics degree course, together with a spell with a software house, she is unlikely to experience great difficulty.

"Many of the programming enquiries are from people, often children, wanting to know how to deal with data read and store. There are two standard letters we send dealing with cassette loading difficulties, problems experienced with the 16K RAM pack, and hints on how to save and load with the ZX-81.

"If there is anything really specific which requires a separate answer, I will see what needs to be done and send a reply", she says.

If she receives a number of queries about one subject, she considers compiling a new standard letter to solve the problem.

The only queries in her sphere which she sometimes finds difficult to handle are those connected with engineering. Yet there is no problem there, because she can go to the engineers at any time.

Questions she deals with alone include modification of the ZX-81 and enquiries about the circuit in the machine.

Her secretary deals with the general administration of the small technical enquiries department but the two share an office with five girls comprising the sales and administrative department.

If she is particularly inundated with paperwork and is unable to answer a telephone enquiry, the other girls are capable of dealing with basic technical questions, like saving and loading.

The method of handling enquiries by telephone is just as efficient as dealing with the mounds of mail. Since December she has set up a logging system recording every telephone enquiry with which she deals. For each call she answers she notes the date on which it occurred, the time of day, the caller, and the points the caller makes—in her own code.

Frequently callers telephone again and her log enables her to find quickly and easily what the previous enquiry was about.

At the moment there are no plans to employ another technical expert to lessen the workload but if interest in the ZX-81 continues to grow as much this year as it did last year, it will not be long before the technical advice department expands to keep customers satisfied.

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Microfair mania





MICROMANIA hit Westminster Central Halls again recently when the second ZX Microfair was held there.

Our photographer has captured the atmosphere of the thronging crowds who had to wait up to four hours before getting into the show.

No wonder show organiser Mike Johnston is looking exhausted but pleased (bottom right) . . . some 7,000 people paid 50p each to fight their way round to the 70 exhibitors.

Mike, who is pictured with his band of helpers, is at the moment planning his next Microfair which, to help avoid the massive queues, is being held over two days on Friday, April 30 and Saturday, May 1.









SO YOU have taken the plunge and bought your ZX-81—now what? You may have a specific use for the machine in mind or you may simply be fascinated by the prospect of owning your own computer and keen to learn more about it. Here are a few general hints to help you.



Don't panic

If all you know about computers so far is that they usually try to take over the world in science fiction films, do not worry. The ZX-81 was designed for you. You do not have to be a genius or a mathematical wizard to use it. This computer was made with the beginner in mind and will let you learn in easy stages and take you on to advanced computing.

The ZX-81 is fairly robust and tolerant of mistakes, so nothing you do to it in ordinary use will cause any damage to it, or to your television or cassette recorder.

You can enter anything you like from the keyboard; it will not necessarily work but it certainly will do no harm. If the worst happens and you find strange pictures on the screens, or the keyboard will not respond, you pull out the power plug, wait for a second or two, plug it back and your machine is as good as new.

Remember only to do that as a last resort, because you will lose everything you have typed-in. The programs you put in will stay there only while the power is on.

Setting up

The instructions for setting-up your computer on page seven of the manual are reasonably comprehensive and you should normally have no problems. It is worth checking, if you have just opened the box, to make sure you have all the correct pieces— a ZX-81, a power supply unit, a manual, an aerial lead and a pair of cassette leads. Connect up, turn on the power—remembering to keep the TV volume low to save your eardrums—and tune to channel 36UHF. You may have slight difficulty locating the UHF tuner on your TV because some manufacturers manage to conceal it fairly skilfully. If you have a push-button model, switch to an unused channel and turn the push button.

On other models the tuner is at the back of the set or sometimes in a pull-out tray at the front. Once you have tuned-in, you should see a black square in the corner of the screen with a white 'K' like the picture in the manual. If the 'K' does not appear, double-check that you have everything plugged-in to the correct sockets and that power is on, then re-set the machine by unplugging the power for a second or so and try tuning again.

The 'K' will take fractionally longer to appear if you have a 16K memory connected. If the picture remains fuzzy or unsteady you may need to adjust the vertical or horizontal hold on the TV and check the aerial lead for loose connections. If all that fails, try another set before you send for a replacement.

It can save family arguments if you can afford a separate TV for your ZX-81; you can buy a cheap portable set for around £50 or obtain a second-hand one even more cheaply. Similarly, it makes life easier if you can find a corner somewhere to leave your equipment permanently set up—unplugged. You will find that you use a few power sockets for your system and a four-way block connector on a short length of extension cable helps to tidy trailing leads.

Talking to your ZX-81

The ZX-81, like a pocket calculator, 'understands' numbers and signs like plus and minus. It is far more sophisticated, however, than a calculator and can also cope with letters and words—those on the keyboard—provided they are presented in the proper way.

A calculator follows the rules of arithemtic; the ZX-81 uses an artificial language designed for computers, called Basic. There are many computer languages but Basic is a good general-purpose one, fairly easy for non-computer specialists to learn and found widely on microcomputers.

Most manufacturers have their own slightly different version or dialect of Basic and Sinclair is no exception. What this means, in practice, is that a program—a series of instructions to the com-

What to do now you have bought your Sinclair

Don't panic! Here is the *Sinclair User* beginners' guide

puter—written for one machine will not work on another without some modification but if you understand Sinclair Basic you can soon learn the minor peculiarities of other versions and, with a little practice, adapt them for the ZX-81.

You do not need to wait to learn the language to start. You can copy the programs you find in *Sinclair User*. A word of warning. Make sure you copy them exactly. You may understand a sentence with a comma or a quote omitted but your ZX-81 relies on those cues and the program will not work without them.

For that reason, it is a good idea to SAVE a program on cassette tape before you press RUN and NEWLINE to make it work. That way, if you have made a mistake and you lose the program from the computer, you can LOAD it back quickly from the tape and look for the error, without having to type it in from the beginning.

You can also buy a wide variety of commercially-produced, pre-recorded programs on cassette. They can vary a good deal in quality and you will need to read the reviews and use your judgment to choose the best.

A good deal of the interest and fun of having your own computer is in writing your own programs, which is easily as fascinating as playing even the best game of *Space Invaders* written by someone else. The manual deals thoroughly with Sinclair Basic but if you find it heavy going or not to your taste, there are plenty of books available for the ZX-81. Check your local bookshop and find one which suits you.

Many people feel that the best way to learn is to plunge in at the deep end and see what you can make the computer do. Refer to the manual if you have difficulties. You can ignore the functions and calculations initially and experiment with PRINT statements to get the feel of your machine. The beauty of having your own computer is that you can learn at your own pace in the style which suits you best.

Keeping your programs

You lose the program contents of your computer when you turn off the power but you can take a copy of the program, because the ZX-81 can reproduce the instructions you have typed-in as a coded sound signal which you can record on to ordinary cassette tape. When you want to use the program you play it back to the ZX-81 and it translates the coded sound back as your program.

To record a program, you SAVE it and to play it back you LOAD it. Chapter 16 of the manuals tells you in detail how to do it. You may have problems occasionally in LOADing, usually with tapes recorded by other people. One way to deal with that is to wind the tape to the middle of the program and type LOAD " " followed by NEWLINE, then slowly turn up the volume of the recorder with the tape running until the television screen shows four or five horizontal black bands. If you then re-wind the tape, the program should load normally at the volume setting.

Carry on computing

Finally, a health warning. Apart from any practical uses, computing with your ZX-81 can be a very entertaining hobby and is almost certainly habit-forming. You may easily find yourself crouched over your machine, red-eyed, in the early hours of the morning, thinking that in another five minutes you will sort out the problem. Try to break that habit by getting into the fresh air and meeting other Sinclair users; it undoubtedly will help your programming—and your non-computing friends, poor souls, will probably be sick to death of hearing about computers by that time in any case.

By getting a ZX-81 you will find you have joined a not very exclusive club with many thousands of members, many of whom would be only too happy to advise you if you have problems. *Sinclair User* will help you to get in touch with other users by printing a list of clubs each month.



Andrew Hewson, author of *Hints & Tips for the ZX-80* and *Hints & Tips for the ZX-81*, answers questions on hardware and software for

Questions organise

HELLO and welcome to HELPLINE. Each month I shall answer a selection of letters from my postbag on a theme of interest to Sinclair users. Often I shall refer to pages in the manual supplied with the ZX machines and this month the questions centre on chapters 27 and 28 of the ZX-81 manual which are about the Organisation of Memory and the System Variables. The first request, from Mr Adler of Harpenden is:

"Please explain the meaning of an "address". How can a byte, which is a number, have an address?"

An important part of a computer is its memory and typical microcomputers have several thousand memory locations available for immediate use. Clearly each location needs a separate label or address to distinguish it from its fellows. The word address came into use because writing information to one of many memory locations is similar to writing a letter to one of many people. Letters are sent to an address so that they reach the person who lives there. Similarly, a computer sends information to the memory location at a given address.

Computer addresses are simply whole numbers starting at zero; so, for example, in the unexpanded ZX-81 locations 0 to 8191 are used by the ROM, locations 8192 to 16383 are unused, and locations 16384 to 17407 are used by the RAM. The add-on 16K RAM uses locations 16384 to 32767. Only the contents of RAM may be altered and so users are generally interested in addresses 16384 and upwards.

Each location in memory contains one byte of information. A byte can be thought of as a whole number between 0 and 255 inclusive. In practice, the word byte is often also used to mean a "location in memory" as well as to mean the number which is stored at that location. Thus if location 17000 contains 34, we might say "byte 17000 is 34".

The next question, from Mr Lypartin of Paignton develops our theme:

"I am keen to understand how my ZX-81 works but as a beginner I am perplexed by the manner in which addresses are stored in the system variables. I know, for example, that D-FILE is the beginning of the display file—but how is that information stored?"

The area at the bottom of RAM between 16384 and 16508 holds the system variables and is followed by the program area, starting at 16509. The display file is next but as programs can vary in length, the display file does not start at a fixed address. The ZX-81 keeps track of it by storing the current value of the starting address in D-FILE.

If you look at page 178 of the manual you will see that the value of D-FILE is stored at address 16396 and so you might infer that you have only to look at the contents of 16396 to find the value of D-FILE.

Unfortunately, that is not true. Remember that the value of D-FILE is an address and that addresses are whole numbers, like 16384 and 17407 and 32767. A single location can only hold a number between 0 and 255 and so two adjacent locations are used to store larger numbers. The value of D-FILE is given by:

value held in 16396 + 256 * value held in 16397

Any whole number between 0 and 65535 inclusive can be stored using this system.

The value held at an address can be found by PEEKing at it and so you can PRINT the value of D-FILE by entering:

```
PRINT PEEK 16396 + 256 * PEEK
16397
```

You may know that the contents of the first location in the display file is always 118 and you can show that by entering:

```
PRINT PEEK (PEEK 16396 + 256 *
PEEK 16397)
```

Finally, I have been asked many times if there is a simple way of allowing two programs to use the same variables. Mr Peters of Blackpool asks:

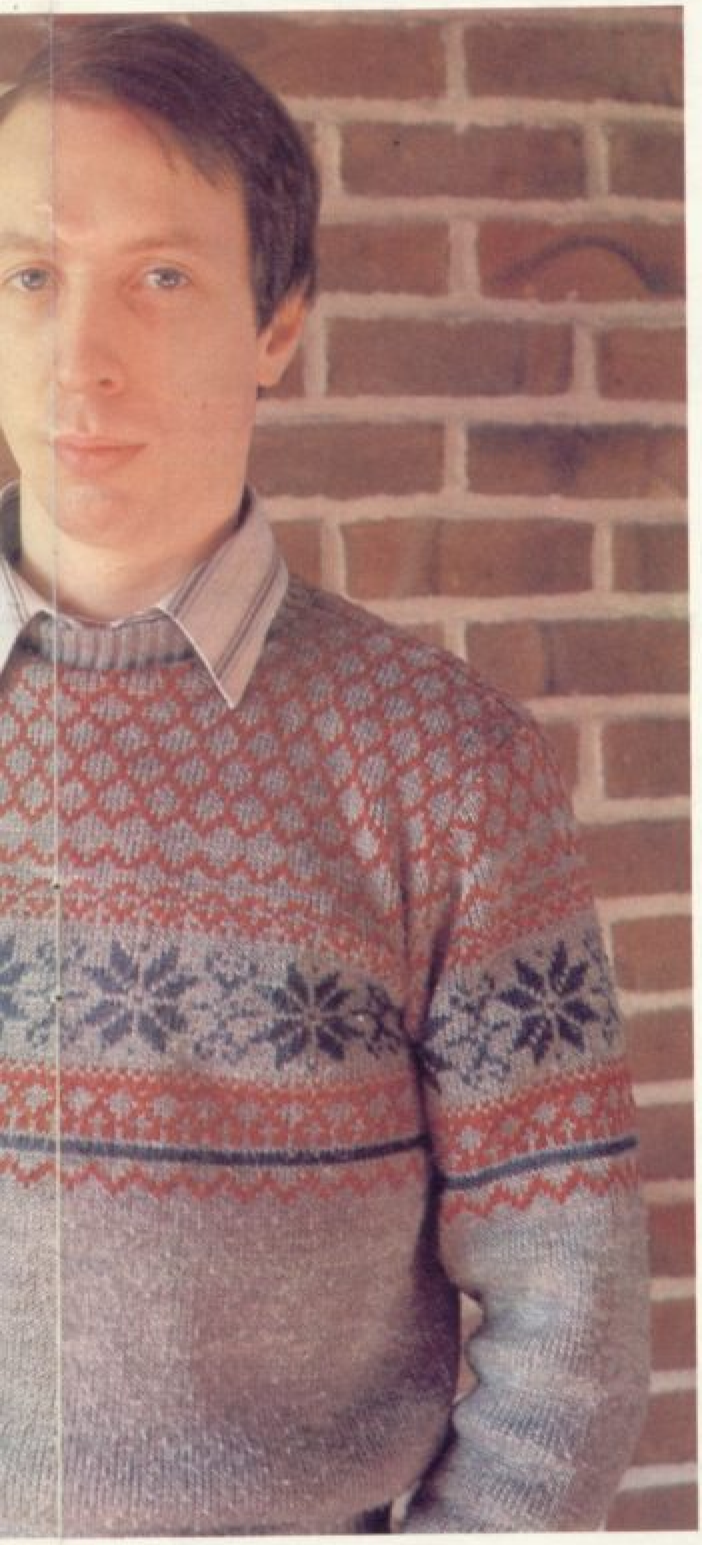
"I want to write several programs which use the same data but there seems to be no way to do so using the Sinclair functions. Do I have to write routines to save and



Andrew Hewson: with the right advice.

Sinclair ZX computers. Please address your problems, queries and comments to Andrew at 7 Grahame Close, Blewbury, Oxon.

s on how to e memory



load data on cassette or is there some way of passing data between programs directly?

There is. The trick is to alter the RAMTOP system variable to give you some space at the top of RAM which is out of reach of the Sinclair system in normal use. Your first program can then copy data into the area above RAMTOP. You can then load a second program, replacing the first, but the data saved above RAMTOP will still be intact. The second program can then copy the data back into its own variables area.

Let us take the job step by step. All the calculations following refer to the unexpanded ZX-81 with values for the 16K expansion in square brackets where they are different.

● **Moving RAMTOP.** Suppose you want to pass a 10-element array between programs. A single-dimensional array occupies five bytes per element plus another six making 56 bytes in all, and so you need at least 56 bytes above RAMTOP.

When you switch on your ZX-81, RAMTOP is set automatically to one more than the top of RAM, i.e., 17408 [32768 with the 16K RAM]. The address is stored as a system variable at 16388 and 16389 as the values 0 and 68 respectively [0 and 128], because 0 + 256 * 68 = 17408 [0 + 256 * 128 = 32768].

You can use your ZX-81 to calculate the new value to be POKEd into 16388 by entering:

```
PRINT 17408 – N – 256 * INT ((17408 – N)/256)
[PRINT 32768 – N – 256 * INT ((32768 – N)/256)]
```

Using N = 56 for our example gives 200.

The value to be POKEd into 16389 is given by:

```
PRINT INT ((17408 – N)/256)
[PRINT INT ((32768 – N)/256)]
```

In our example the result is 67 [128].

The ZX-81 will ignore any alterations to RAMTOP until you enter NEW, so do so at that point. Of course, if you have a program in your machine you should SAVE it first.

● **Finding your array.** Variables are stored at the address held in VARS at 16400 and 16401 so you can PRINT the current value by entering:

```
PRINT PEEK 16400 + 256 * PEEK 16401
```

● **Saving an array above RAMTOP.** The following program demonstrates the technique:

```
10 DIM A(10)
20 FOR I = 1 TO 10
30 LET A(I) = I
40 NEXT I
50 LET J = PEEK 16400 + 256 * PEEK 16401
60 LET K = PEEK 16388 + 256 * PEEK 16389
70 FOR I = 0 TO 55
80 POKE (K + I), PEEK (J + I)
90 NEXT I
```

Lines 10 to 40 assign the array and set its values to 1...10—these values have been chosen for the purposes of this demonstration and have no special significance. Line 50 stores the value of VARS in J and line 60 stores the value of RAMTOP in K. The loop at lines 70 to 90 copies the contents of the array above RAMTOP.

● **Retrieving an array from above RAMTOP.** Now delete the first program and enter the following:

```
10 DIM A(10)
50 LET J = PEEK 16400 + 256 * PEEK 16401
60 LET K = PEEK 16388 + 256 * PEEK 16389
70 FOR I = 0 TO 55
80 POKE (J + I), PEEK (K + I)
90 NEXT I
100 FOR I = 1 TO 10
110 PRINT A(I)
120 NEXT I
```

In this program the array is assigned and J and K are set to VARS and RAMTOP as before but the loop at lines 50 to 780 now copies the data from above RAMTOP to the variables area. The loop at lines 100 to 120 PRINTs the values of the array as set by the first program.

In each case, lines 50 to 90 represent the essential part of the program but it is important to assign the array at the beginning of the program, so that it lies at the bottom of the variables area. The same technique works for ordinary variables but strings cannot, in general, be copied in this manner, because they can move around in RAM.

For Subscription Form
see page 64

Lack of ZX81 memory giving you headaches..?



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16-32K...This area can be used for basic programmes and assembly language routines.

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THE INTRODUCTION of the ZX-81 into an educational environment has greater value than many people imagine. It may look like a toy—and perhaps deserved the label when first introduced—but independent suppliers have joined forces with Sinclair to produce an impressive array of add-ons which enhance the machine considerably, RAM expansion, high-quality software and peripherals mean the ZX-81 is capable of sophisticated operations.

From simple awareness to program writing and word processing, the ZX-81 has value and can withstand a surprising amount of robust hands-on use, given a certain amount of attention with a soldering iron. The beauty of this particular micro is, of course, its price. Educational suppliers include Sinclair Research, Griffin and George and W H Smith, all of which offer the offical range of hardware and software, most with educational discounts.

For the same price as the Pet or Apple, for instance, you could buy 10 ZX-81s, providing a greater spread of usage. The machine obviously has limitations—the absence of disc storage, for example—and cannot compare to the versatility of some of the more powerful micros but it performs admirably within its scope.

Students at North London Polytechnic and at many other higher education establishments consider the ZX-81 to be a standard piece of equipment, something without which they cannot manage to handle standard number-crunching, program analysis and computing/statistical study in specific subject applications.

At the other end of the curriculum, the ZX-81 is a useful tool in primary education. The only disadvantage might be the keying-in of input—the touch-sensitive keyboard may prove difficult for younger children to use. The cost of the ZX-81 is well within the limited budget of a primary school and is a worthwhile investment to enable children to develop an awareness and can be used to present material in an unusual and interesting way.

Why Sinclairs are such a smash hit

From primaries to polytechnics . . the whole education spectrum is using ZX-81s



Sheffield schoolchildren and their ZX-81s.

One branch of the Youth Opportunities Programme aims to give hands-on experience to a number of unemployed teenagers. Using two ZX-81s, the youngsters tried simple programming techniques, gaining a valuable awareness of what a computer is capable of doing. Some of the users have written their own programs and developed some interesting applications, including control experiments.

One school which, despite a long wait for delivery of two ZX-81s, is now using the micros happily is Arbourthorne Middle School, Sheffield. Originally, it was intended to use the ZX-81s for staff familiarisation in computer hardware and programming techniques. Stephen Dommett, a member of staff keen to promote the use of micros in the school, decided to try the equipment with his pupils.

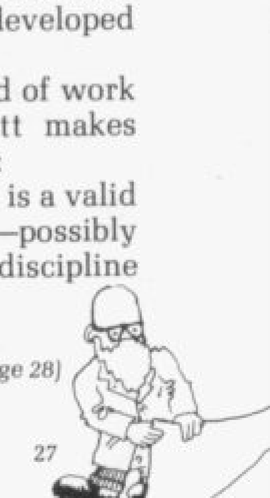
Together with a series of home-designed work sheets, he was encouraged by pupil response. Interested children in his class arrived early, worked through their lunch break and stayed after hours. He had this to say about his experience:

"The single-stroke keywords? Confusing at first, I admit, but it takes about two minutes to get the idea and it makes children's typing much faster. Non-standard Basic? Who cares? By the time children using the ZX-81s are ready for something with disc drives and high-resolution colour graphics, all the machines and languages will have developed anyway".

After only a short period of work with the ZX-81s, Dommett makes the following observations:

● Computer programming is a valid subject for 11-year-olds—possibly younger. They have to discipline

(continued on page 28)





(continued from page 27)
their thoughts to use the language, yet creativity and imagination are also required, and rewarded, when a program works.

● The Sinclair is the ideal machine to start, not just because you can afford sufficient of them to make it worthwhile but because of the single-stroke keywords and user-friendly Basic.

"We do not envisage our ZX-81s being used solely for learning programming. It is just that educational programs take longer to develop". In fact, because of increased usage and interest in the ZX-81, there is now a significant number of educational packages, both commercial and home-produced. The educational users group, EZUG, produces a comprehensive list of programs available.

"The plan for this academic year", he comments, "is for all interested pupils to start programming and for every child in the school to lay hands on a micro for a few minutes each week, playing games which will be entertaining and useful. Only time will tell if it works but it will have been fun for me, too".

The ZX-81 is, there can be no doubt, a sound microcomputer. The PCB is Z-80-based and can cope with the majority of tasks. The area which causes concern, however, when one talks about continued usage with children, is the connections and sockets at the back and sides of the machine.

One hint is to solder the power supply and UHF lead for video output into the main body of the ZX-81. That prevents program crashes, especially in the unstable environment of a school classroom.

The same is true for the RAM expansion packs now available—up to 48K—which greatly enhance the capabilities of the machine. The connection at the rear is vulnerable and it is advisable to construct some kind of base to which the micro and expansion packs can be attached. Another advisable amendment to the basic system is the addition of a mechanical QWERTY keyboard.

With those changes, however, you are no longer considering a £70 micro but one more in the region of £150. You then have to consider the point of buying an inexpensive system compared to something like the Atom or BBC machine which is more expensive initially but gives you a more sophisticated tool without the need for add-ons.

All things considered, the ZX-81 has an important role to play in the classroom, within its inherent physical limitations. When the sockets are secured and more RAM added, you have a useful piece of equipment—there is no doubt about that.

8 PAGES OF PROGRAMS

for both the ZX-80 and the ZX-81

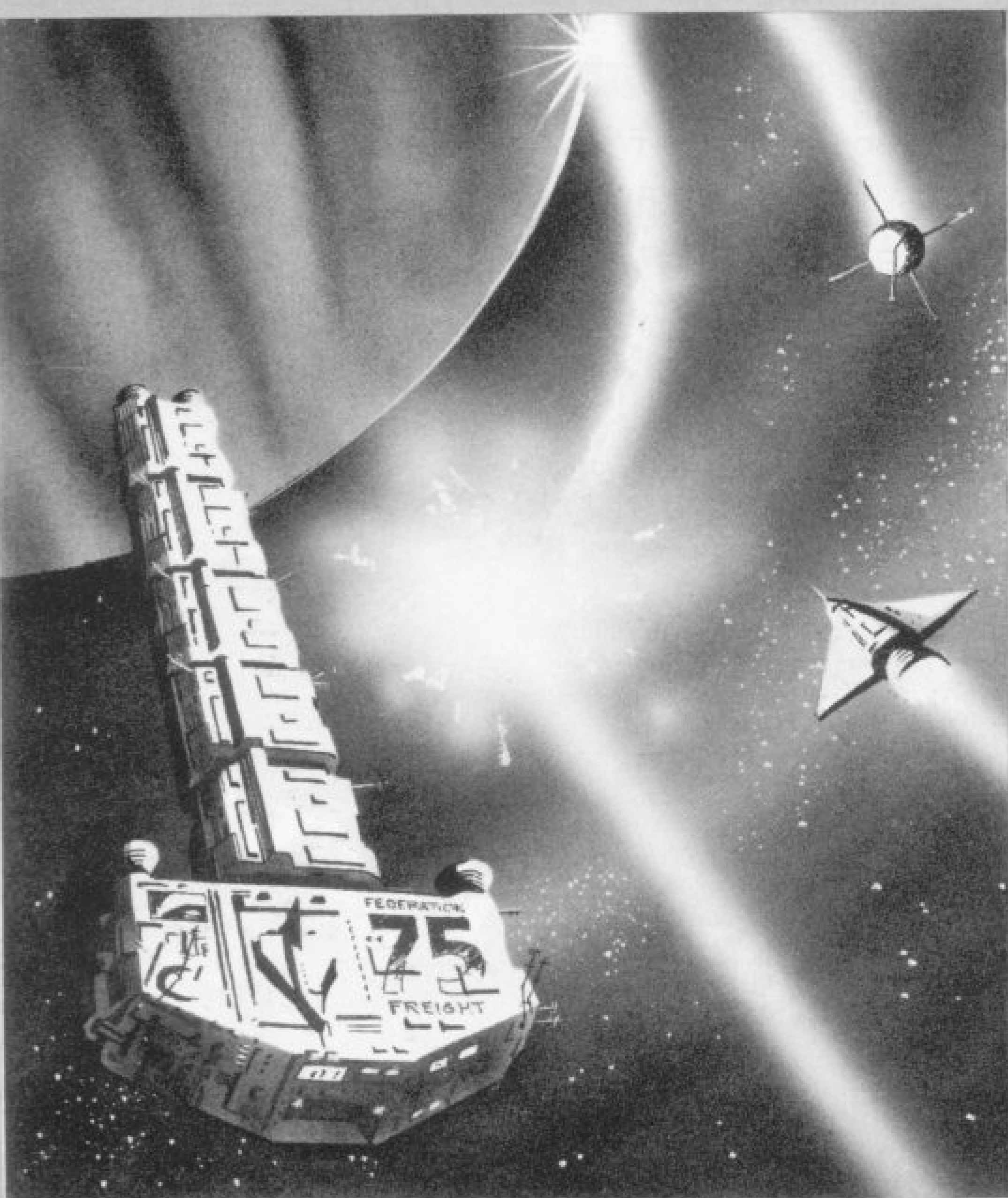
INTERCEPT, written for the ZX-80 by Ian Wright of Weybread, Diss, makes good use of POKEing to the screen. The aim of the game is to destroy the enemy missile—a less-than symbol—with your intercept missile (*) before the Federation Freighter—an inverse plus sign—is destroyed.

If you succeed, the Freighter remains on the screen with the message INTERCEPTED. If you do not, the missile hits and only the message DESTROYED remains. The game is relatively simple if no mistakes are made.

The missile is launched from a different position each time. To make the game more difficult, once you have mastered the version as listed you can delete several lines, making, for example, D equal to 14 and FOR F = 1 TO (527 − 66), and allowing the enemy missile to move at random.

Then, of course, you have the problem of how to make it destroy the Freighter each time, without writing more program than you can fit in 1K. You may well like to tackle the problem. We would be interested in seeing what variations on the game you produce.

INTERCEPT




```
10 LET A$ = "$"
20 LET D=16
30 LET E= RND(9)+5
40 LET A=16794
50 LET G= A+384
60 LET B= A
70 FOR F=1 TO 527
100 PRINT "";(space)
110 NEXT F
120 LET C= A+33*D+E
130 LET G=G-34
140 IF G= B THEN GOTO 600
150 IF G=C THEN GO TO 557
160 IF C < A THEN STOP
170 POKE C, 20
180 B, 147
190 POKE G, 24
200 INPUT A$
210 IF A $ = "" THEN GOTO 200
220 POKE C, 0
230 POKE B, 0
240 POKE G, 0
245 LET B= B+1
250 LET D= D-1
260 GOSUB CODE(A$)*10
270 GOTO 120
490 LET E=E-2
500 RETURN
550 LET E=E+1
555 RETURN
557 PRINT "(SHIFTS) INTERCEPTED
(SHIFTS)"
558 POKE B, 147
560 STOP
580 LET D= D-1
590 RETURN
600 PRINT "(SHIFT A)
     DESTROYED (SHIFT A)"
610 STOP
```

Star Swerver

FOURTEEN-year-old Tim Rogers of Richmond, Surrey, provided us with this splendid game, in which you have to steer your space ship—a minus sign followed by a less-than symbol—past the stars which block your path as you whizz across the little inverse universe which the 1K ZX-81 sets up for you in SLOW mode.

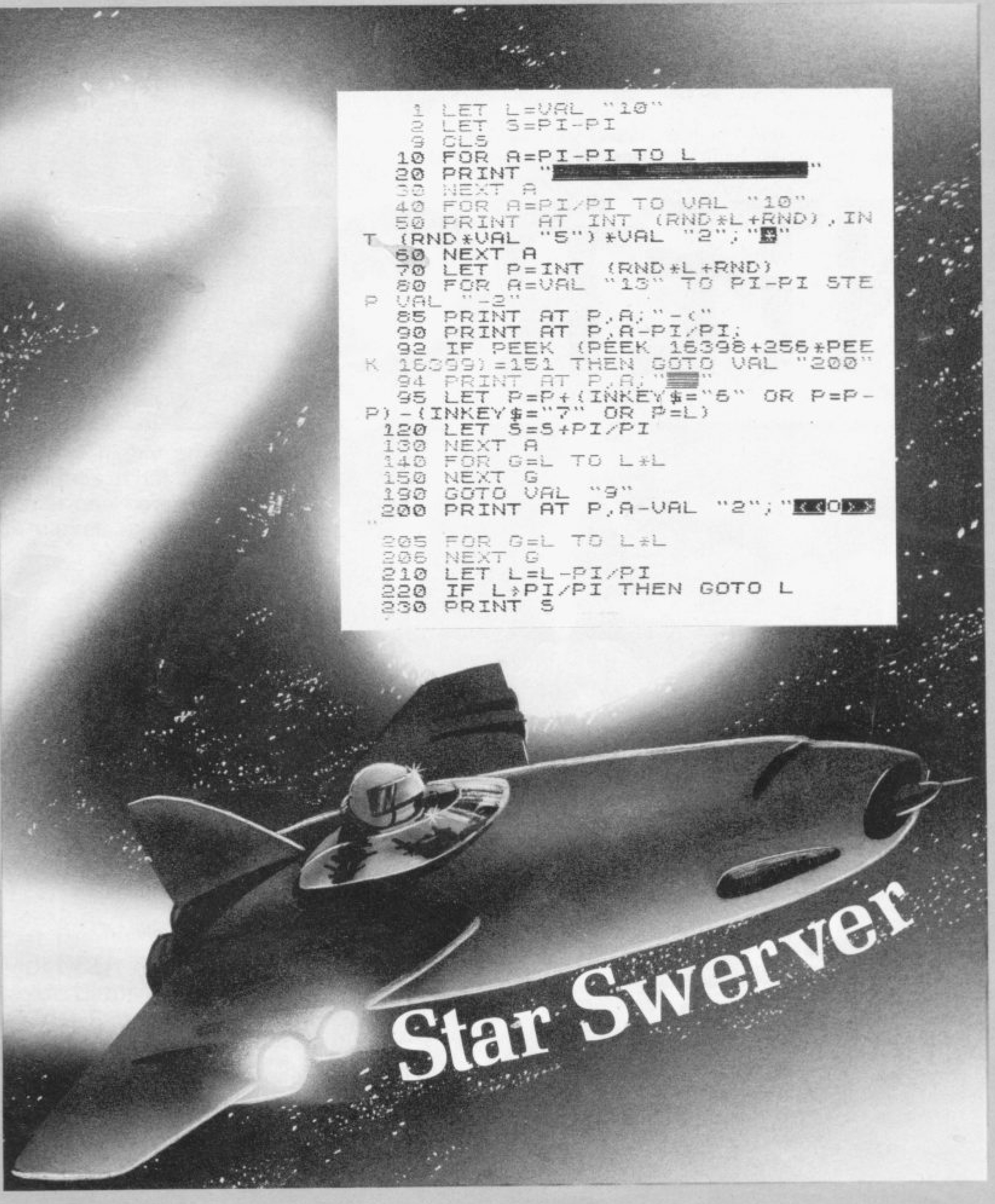
Each time the computer creates the universe with stars, you have a chance to see where they are placed, so that when your ship enters the universe at a random height from the right, you will have some idea of where to steer to avoid them.

Your score is given at the end of the game. Some weird thing happens, about which I will not warn you, when you hit a star. Rogers writes about his program:

"In this game I have used nearly every memory-saving technique I know, including using PI-PI instead of 0 and PI/PI instead of 1.

"I have also used VAL "10" instead of just the number 10. I took the INKEY$ line from Mark Charlton's book *The Gateway Guide to the ZX-81 and ZX-80* and I think it is very clever. It works like this:

95 LET P = P + (INKEY$ = "6" OR P = P − P) − (INKEY$ = "7" OR P = L). The variable P is the position up the screen of the space ship, so that if someone is pressing "6", the statement inside the brackets is true and thus returns a 1, which is added to P, and as it is false—i.e., "7" not being pressed—0 is returned and taken away from P".



```
  1 LET L=VAL "10"
  2 LET S=PI-PI
  3 CLS
 10 FOR A=PI-PI TO L
 20 PRINT "████████████████"
 30 NEXT A
 40 FOR A=PI/PI TO VAL "10"
 50 PRINT AT INT (RND*L+RND),IN
T (RND*VAL "5")*VAL "2";"▣"
 60 NEXT A
 70 LET P=INT (RND*L+RND)
 80 FOR A=VAL "13" TO PI-PI STE
P VAL "-2"
 85 PRINT AT P,A;"-<"
 90 PRINT AT P,A-PI/PI;
 92 IF PEEK (PEEK 16398+256*PEE
K 16399)=151 THEN GOTO VAL "200"
 94 PRINT AT P,A;"▒▒"
 95 LET P=P+(INKEY$="6" OR P=P-
P)-(INKEY$="7" OR P=L)
120 LET S=S+PI/PI
130 NEXT A
140 FOR G=L TO L*L
150 NEXT G
190 GOTO VAL "9"
200 PRINT AT P,A-VAL "2";"<<O>>
"
205 FOR G=L TO L*L
206 NEXT G
210 LET L=L-PI/PI
220 IF L>PI/PI THEN GOTO L
230 PRINT S
```

```
   10 REM SQUARE ROOT SOLVER
   20 REM (C) HARTNELL 1982
   30 SCROLL
   40 PRINT "WHICH NUMBER DO YOU
WANT ME"
   45 SCROLL
   50 PRINT "TO FIND THE SQUARE R
OOT OF?"
   60 INPUT B
   70 IF B<0 THEN GOTO 60
   80 LET A=INT (RND*B)+1
   90 LET X=B/A
  100 LET Y=(X+A)/2
  110 SCROLL
  115 PRINT Y
  117 SCROLL
  120 PRINT "ERROR IS ";ABS (Y-SQ
R (B))
  130 IF A=Y THEN GOTO 160
  140 LET A=Y
  150 GOTO 90
  160 SCROLL
  165 SCROLL
  170 PRINT "THE SQUARE ROOT IS "
;Y

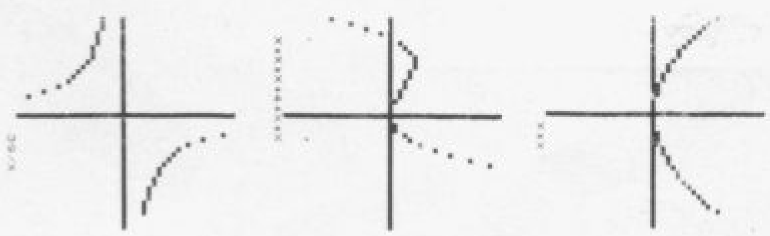

WHICH NUMBER DO YOU WANT ME
TO FIND THE SQUARE ROOT OF?
5
ERROR IS 2
3.4
ERROR IS 0.4
3.0235294
ERROR IS .023529412
3.0000916
ERROR IS .000091554597
3
ERROR IS 1.8626452E-9
3
ERROR IS 0
3
ERROR IS 0

THE SQUARE ROOT IS 3



WHICH NUMBER DO YOU WANT ME
TO FIND THE SQUARE ROOT OF?
1.5
ERROR IS .085786437
1.4166667
ERROR IS .0024531037
1.4142157
ERROR IS 2.1234155E-6
1.4142136
ERROR IS 4.6566129E-10
1.4142136
ERROR IS 4.6566129E-10

THE SQUARE ROOT IS 1.4142136
```



```
   10 FOR N=0 TO 43
   20 PLOT 20,N
   30 PLOT N,21
   40 NEXT N
  100 INPUT A$
  120 FOR X=-5 TO 5 STEP .25
  125 IF X=0 THEN NEXT X
  130 LET Y=VAL A$
  140 IF Y<43 AND Y>-43 THEN PLOT
X*4+20,Y/2+21
  150 NEXT X
  160 GOTO 100
```



SQUARE ROOT

SQUARE ROOT Solver will work out the square root of any number you enter. It first guesses—line 80—by picking any number between zero and the number chosen. The computer then refines that guess by division, over and over again, checking each time to see how close to the correct answer it is.

Line 120 is not part of the computer checking apparatus—which you can verify by deleting the line—but is there so that you can watch the action of the computer as it searches for the correct answer.

As the ZX-81 has SQR function, the program is of little practical use but it is fascinating to run and watch how quickly it finds the correct answer. In the two sample runs, the computer is looking for the square root of nine—example one—and of two—example two.

GRAPH PLOTTER

THIS PROGRAM, which is fascinating to run, was written for a 1K ZX-81 by R Easto of Reigate, Surrey. He describes it as follows:

"The program plots the graph of any curve entered in the form 'X*X – 2 + 4*X' or even '1/X'. Line 130 is the heart of the program, where the VAL command puts Y equal to the values of X required by your formula (entered in line 100). The program allows more than one curve to be viewed at once."

The three sample curves plotted are X*X, X*X*X + 4*X*X and 39/X. Do not use the shift H key (**) for powers of X as an error will result.

```
   1 REM OTHELLO BY G.D.CHARLTON
  10 GOTO 710
  20 LET D=B
  30 LET D=D+D(X)
  40 LET C=CODE A$(D)
  50 RETURN
  60 FAST
  70 LET H=0
  80 FOR B=12 TO 89
  90 LET J=0
 100 LET Q=0
 110 LET D=B
 120 IF A$(D)<>" " THEN GOTO 330
 130 FOR X=1 TO 8
 140 LET K=0
 150 GOSUB 20
 160 LET K=K+1
 170 IF C<>45 THEN GOTO 200
 180 GOSUB 30
 190 GOTO 160
 200 IF C<>40 THEN GOTO 230
 210 IF K<2 THEN LET K=0
 220 LET Q=Q+K
 230 NEXT X
 240 LET B$=STR$ B
 250 LET Y=VAL B$(1)
 260 LET Z=VAL B$(2)
 270 IF Y=1 OR Y=8 THEN LET Q=Q*
2
 280 IF Z=2 OR Z=9 THEN LET Q=Q*
2
 290 IF Y=2 OR Y=7 OR Z=3 OR Z=8
 THEN LET Q=Q/2
 300 IF (Y=1 OR Y=8 OR Z=2 OR Z=
9) AND (Y=2 OR Y=7 OR Z=3 OR Z=8
) THEN LET Q=Q/4
 310 IF Q>H THEN LET M=B
 320 IF Q>H THEN LET H=Q
 330 NEXT B
 340 IF H=0 THEN GOTO 440
 350 FOR X=1 TO 8
 360 LET D=M
 370 GOSUB 30
 380 IF C=45 THEN GOTO 370
 390 IF C<>40 THEN GOTO 430
 400 FOR A=M TO D STEP D(X)
 410 LET A$(A)="C"
 420 NEXT A
 430 NEXT X
 440 IF H=0 THEN LET J=820
 450 GOSUB 640
 460 PRINT "YOUR MOVE?"
 470 INPUT G$
 480 PRINT AT 16,8;"                    "
 490 FAST
 500 LET G=VAL G$
 510 IF G=0 THEN GOTO 60+J
 520 IF G<0 OR G>100 THEN GOTO 4
70
 530 FOR X=1 TO 8
 540 LET D=G
 550 GOSUB 30
 560 IF C=40 THEN GOTO 550
 570 IF C<>45 THEN GOTO 610
 580 FOR A=G TO D STEP D(X)
 590 LET A$(A)="H"
 600 NEXT A
 610 NEXT X
 620 GOSUB 640
 630 GOTO 60
```

OTHELLO is based on the game Reversi, which was invented in 1888. Reversi was played on a standard draughts board, using pieces which were double-sided, black on one side, red on the other, R C Bell explains, in his book *Discovering Old Board Games*, Shire Publications Ltd, Aylesbury, 1980, that black begins the game by placing a piece black side up on one of the four central squares on the empty board.

Red replies by placing his first piece red side up on another central square. "The four squares are covered in the first four turns of play and then the players continue alternately, placing their pieces on a square adjacent to one occupied by an enemy piece", says Bell.

Any enemy pieces in a straight line between the latest piece placed and another one of the player's pieces is then flipped over to show the colour of the player. The winner is the player with the most pieces when the board is covered, or when neither player may move.

A member of the National ZX-80 and ZX-81 Users' Club, G J Suggett, of Chichester, Sussex points out, when discussing computer Othello, which is simply Reversi with a restriction on the opening position:

"Most published Othello programs evaluate the best move for the computer to make on the basis of



maximising the number of captures made with a possible extra score given to certain positions, such as the corners.

"In fact, in the early stages of the game, positional play is far more important than making a large number of captures".

This program, by Graham Charlton and Tim Hartnell, lends more weight to position than to the number of pieces available to convert. When you press RUN, you will see the board appear with the four first pieces in place. You enter a move by entering the number down the left-hand edge of the board next to the square where you want to move, then the number across the board of that square. Enter those numbers as a single number, such as 36, then press NEWLINE. Enter zero if you are unable to make a move.

Once you have played a few games with the program, you might like to alter its strategy slightly by changing the 2 in lines 1220, 1230, 1240, 1250, 12650 and 1270 into 3 or even try deleting the lines completely, perhaps by adding 1215 GOTO 1280. The name Othello is copyright by Mine of Information, which sells a sophisticated ZX-81 machine code program under that name. A 1K version of the game, also in machine code, is available from Logan Software.

ELLO

```
 640 SLOW
 650 PRINT AT 6,8;
 660 FOR F=1 TO 100
 670 PRINT A$(F);
 680 IF 10*INT (F/10)=F THEN PRI
NT TAB 8;
 690 NEXT F
 700 RETURN
 710 FAST
 720 LET H=0
 730 LET K=0
 740 DIM D(8)
 750 LET D(1)=-11
 760 LET D(2)=-10
 770 LET D(3)=-9
 780 LET D(4)=-1
 790 LET D(5)=1
 800 LET D(6)=9
 810 LET D(7)=10
 820 LET D(8)=11
 830 LET S=0
 840 LET R=0
 850 LET A$="▒23456789▒1
12        23        34   HC    45
    CH    56        67        78
      8▒23456789▒"
 860 GOSUB 640
 870 GOTO 60
 880 FOR F=1 TO 100
 890 IF A$(F)="C" THEN LET S=S+1
 900 IF A$(F)="H" THEN LET R=R+1
 910 NEXT F
 920 PRINT "I SCORED ";S,"YOU SC
ORED ";R
```

```
▒23456789▒
1        1
2        2
3        3
4   HC   4
5   CH   5
6        6
7        7
8        8
▒23456789▒
```

```
▒23456789▒
1CCCCCCCC1
2HHHHHHHH2
3HHCCHHHH3
4HCHHHHHH4
5HCHHCCHH5
6HHCCHCHH6
7HHHCCHHH7
8CCCCCCCC8
▒23456789▒

I SCORED 27       YOU SCORED 37
```



BLACK

THE CARD GAME Blackjack is very popular. In his book *Beat the Odds, Microcomputer Simulations of Casino Games*—Hayden, 1980—Hans Sagan says it is "probably the most popular and most widely-played banking card game in the States. It is played in gambling houses, private clubs, political clubrooms, barracks, troop transports, back rooms of all kinds, and places you may never have heard of".

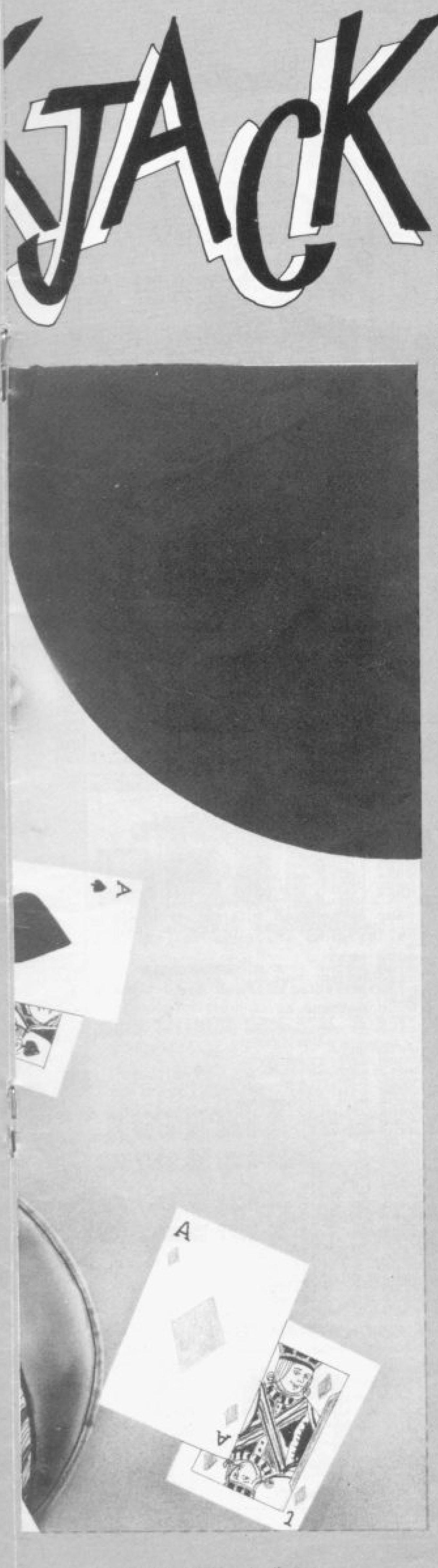
John Scarne, in his authorative *Scarne's Encyclopedia of Games*, agrees: "Blackjack is the most widely-played banking card in the world".

Sagan says Blackjack is "the one casino game where the player may have a chance". Part of that chance is based on the fact that the cards removed from a pack as the game is played change the odds of other cards appearing—and knowing the odds can be of some benefit in deciding what to do. The player advantage is stymied in this version because the ZX-81 has somehow acquired an infinite, constantly-replenished pack of cards.

Despite that, the computer plays reasonably well and will certainly give you a run for your money. There is no direct betting in the game and

```
   5 REM BLACKJACK
         (C) HARTNELL 1982
   7 LET M=0
  10 GOTO 160
  20 LET CA=INT (RND*11)+1
  30 IF CA=11 AND D+CA>21 THEN L
ET CA=1
  35 LET D=D+CA
  36 SCROLL
  37 IF M>1 THEN PRINT CA;" HAS
BEEN DEALT"
  38 LET M=M+1
  40 RETURN
  50 LET CA=INT (RND*11)+1
  60 IF CA=11 AND B+CA>21 THEN L
ET CA=1
  65 LET B=B+CA
  66 SCROLL
  67 IF M>1 THEN PRINT CA;" HAS
BEEN DEALT"
  70 RETURN
  80 SCROLL
  85 PRINT "ENTER 1 FOR ANOTHER
CARD"
  86 SCROLL
  87 PRINT TAB 3;"OR 0 TO STAND"
  90 INPUT G
 100 RETURN
 110 SCROLL
 112 PRINT "ANOTHER GAME, CARDSHA
RP?"
 120 INPUT A$
 125 LET M=0
 130 IF A$<>"NO" THEN GOTO 160
 135 SCROLL
 140 PRINT "OK, THANKS FOR PLAYI
NG";END
 160 SCROLL
 161 SCROLL
 162 SCROLL
 165 LET D=0
 170 LET B=0
 180 GOSUB 20
 190 LET H=CA
 200 GOSUB 20
 210 LET A=CA
 220 GOSUB 50
 230 LET E=CA
 240 GOSUB 50
 250 LET F=CA
```





that is a feature you may well want to add in due course. You may also like to change the program so that it goes through a pack of cards before there is a need to re-shuffle. You can store the pack in a REM statement or in an array.

Blackjack is not difficult to play. You and the computer add the total of the cards you hold, trying to go as close as possible to 21, without exceeding 21. Aces count as either one or 11, and kings, queens and jacks each count 10. The program assigns a value of one automatically to an ace if counting it as 11 would force the total above 21.

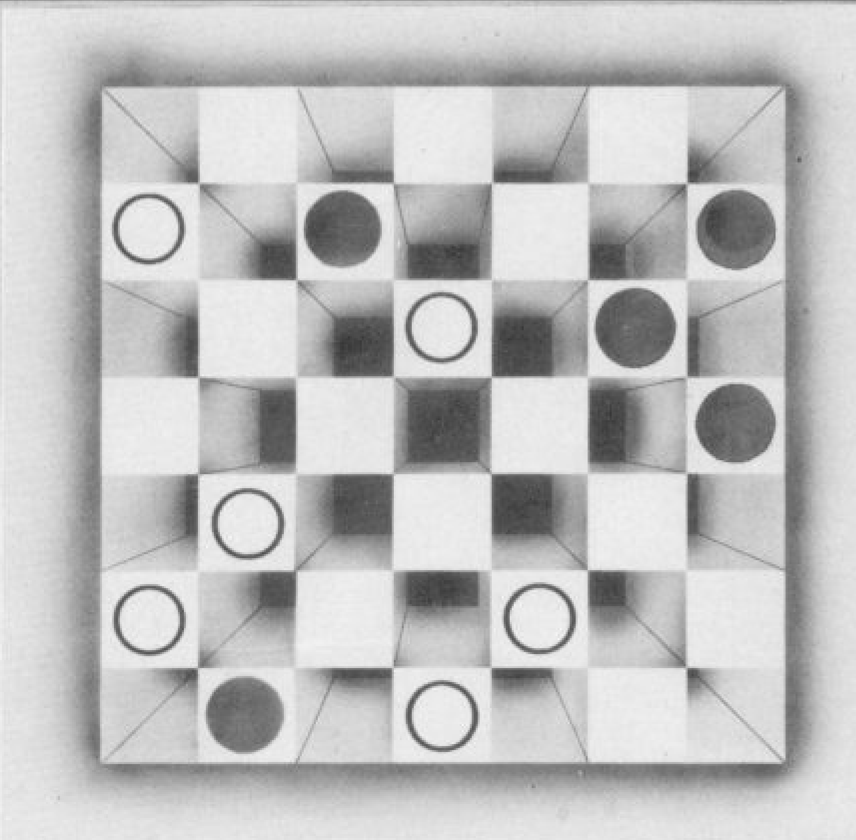
The computer deals two cards to the human and one to itself. You have the option of taking another card at any time during your turn, or sticking—that is, staying with the cards you hold.

The round is a draw if both reach the same total less than 21. If you bust—exceed 21—the dealer (ZX-81) wins the round automatically. You need around 2½K for the game.

Note the use of the word End in line 140. That is not a mistake and it stops the program because the computer 'reads' the word END as unassigned variable and stops the program with an error message.

```
 260 LET B$=" THE ZX81 HAS "
 270 LET C$="THE HUMAN HAS "
 285 SCROLL
 290 PRINT B$;H
 295 SCROLL
 300 PRINT C$;E;" AND ";F
 305 SCROLL
 310 PRINT TAB 4;"TOTALLING ";E+
F
 315 LET D=H+A
 320 LET B=E+F
 340 GOSUB 80
 350 IF G=1 THEN GOTO 490
 360 IF D<17 THEN GOTO 530
 370 SCROLL
 372 IF D<>21 THEN PRINT B$;D
 375 SCROLL
 380 IF D<>21 THEN PRINT C$;B
 385 SCROLL
 390 IF B=D AND B<>21 THEN PRINT
"SO THIS ROUND IS A DRAW"
 400 IF B>21 OR D>21 THEN GOTO 1
10
 405 SCROLL
 410 IF B>D THEN PRINT ,"YOU WIN
"
 420 IF B<D THEN PRINT ,"I WIN"
 480 GOTO 110
 490 GOSUB 50
 500 SCROLL
 505 PRINT C$;CA;" TOTAL ";B
 510 SCROLL
 512 IF B>21 THEN PRINT ">>>>BUS
TED"
 515 IF B>21 THEN GOTO 110
 520 GOTO 340
 530 SCROLL
 534 PRINT B$;D
 535 FOR Y=1 TO 60
 536 NEXT Y
 540 GOSUB 20
 550 SCROLL
 570 PRINT "TOTAL IS NOW ";D
 575 FOR Y=1 TO 60
 576 NEXT Y
 577 SCROLL
 580 IF D>21 THEN PRINT ">>>>BUS
TED"
 590 IF D<17 THEN GOTO 540
 600 GOTO 370
```

Old Forty-niner



THIS GAME is somewhat like draughts, except that it is played on a 7 × 7 board, hence the name *Old Forty-niner*. The pieces move as draughts pieces—diagonally one square, jumping over an opponent for a capture into an empty square beyond the opponent. The main differences from draughts, apart from the size of the board, are that pieces may move forward and backward at will, there are no kings—every piece can move as if it is a king—and there are no multiple jumps.

The computer is the Xs moving down the screen and you are the Os. You move by entering the number of the square from which you are moving—entering the number along the left-hand edge first, then the number across the top, then pressing NEWLINE—then the number of the square from which you are moving.

The ZX-81 keeps track of the score, tells you before it moves its pieces to which square it is moving, and terminates the game as soon as one player manages to capture five of the opponent's pieces.

The program, which needs about 3½K, was written by Tim Hartnell and shows some structured programming techniques. Line 30 sends the action to a subroutine at the end of the program which initialises the variables. The computer then goes to its move routine, starting at 7000.

Having made a move, it returns to line 50, enters the SLOW mode and goes to the subroutine at line 8000 to print-out the board. From there it goes to subroutine 6000 to accept the player's move, to 8000 to reprint the board, into FAST (line 100) then back to make the computer's next move, and so on.

The advantage of working in that way, with a specific subroutine for each section of the program, is that you can easily alter part of the program which appears unsatisfactory without facing the danger of running out of lines, or of getting lost. Placing the variables assignment at the end has the advantage that you can add new ones, as the need for them becomes apparent, without problems. The layout of the program is simple:

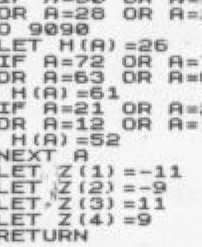
1-1000 Main loop, sends action to various subroutines.
6000-6990 Accepts players move, updates score for player.
7000-7470 Makes computer's move, updates ZX-81 score.
8000-8990 Prints-out board, score, checks if game is over.
9000-9140 Assigns variables.

Although this is not the most memory-efficient method of programming, it makes the work of debugging and future development of a program much easier.

If you would like to learn about structured and top-down programming, you could do well to read *Basic With Style* by Paul A Nagin and Henry F Ledgard, published by the Hayden Book Co Inc.

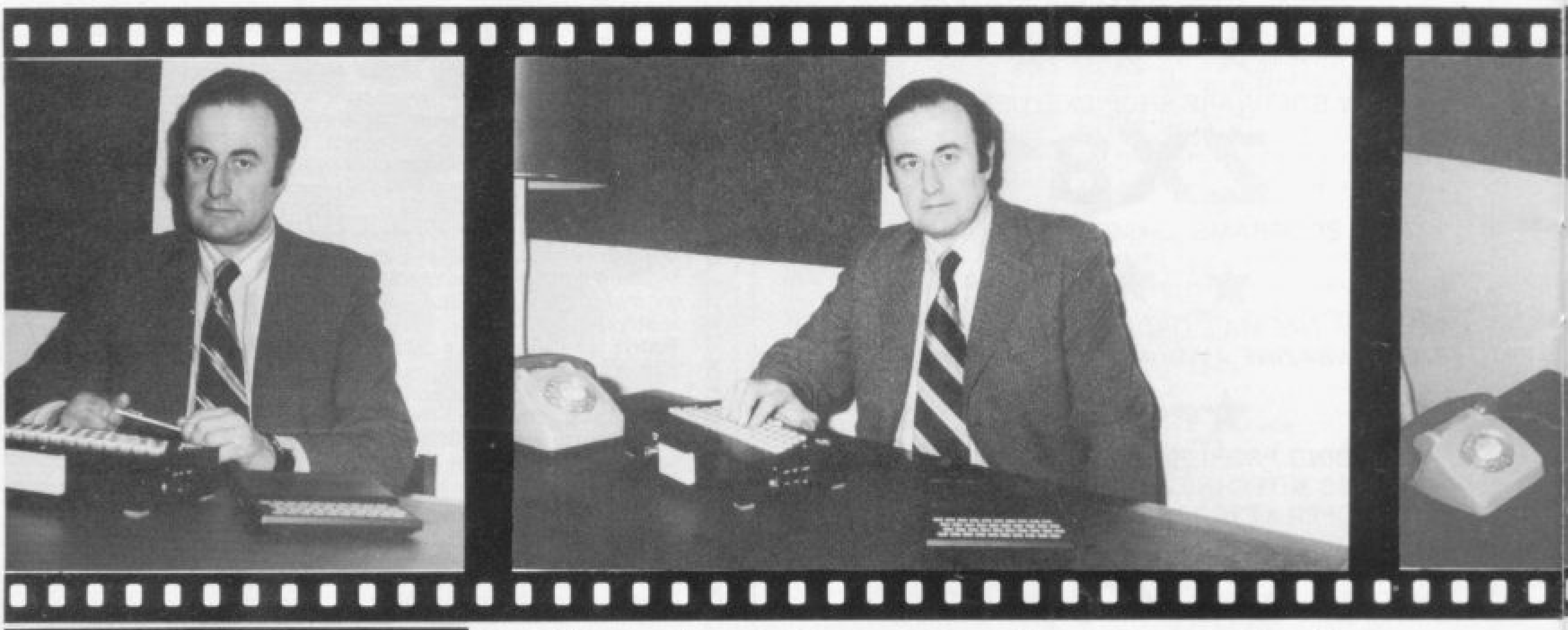
```
   5 FAST
  30 GOSUB 9000
  40 GOSUB 7000
  50 SLOW
  60 GOSUB 8000
  70 GOSUB 6000
  90 GOSUB 8000
 100 FAST
 110 PRINT AT 0,0;
1000 GOTO 40
6000 PRINT AT 2,0;"FROM?"
6060 INPUT M
6070 PRINT AT 2,0;M;" TO?"
6080 INPUT N
6085 PRINT AT 2,0;"          "
6087 PRINT AT 0,0;
6090 LET H(N)=52
6095 IF ABS (M-N)=22 OR ABS (M-N
)=18 THEN LET H((M+N)/2)=26
6096 IF ABS (M-N)=22 OR ABS (M-N
)=18 THEN LET ME=ME+1
6100 LET H(M)=26
6990 RETURN
7010 FOR A=76 TO 12 STEP -1
7020 IF H(A)<>61 THEN GOTO 7060
7030 FOR B=1 TO 4
7032 IF A<26 AND B<3 THEN GOTO 7
050
7033 IF A>60 AND B>2 THEN GOTO 7
060
7035 LET Q=2*Z(B)
7040 IF H(A+Z(B))=52 AND H(A+Q)=
26 THEN GOTO 7070
7050 NEXT B
7060 NEXT A
7065 GOTO 7300
7070 LET H(A+Z(B))=26
7080 LET H(A)=26
7090 LET H(A+Q)=61
7092 LET Y=A+Q
7093 LET X=A
7095 LET IT=IT+1
7100 RETURN
7310 LET Y=0
7320 LET Y=Y+1
7330 LET K=INT (RND*66)+12
7340 IF H(K)<>61 AND Y<100 THEN
GOTO 7320
7350 IF H(K)<>61 THEN GOTO 7460
7360 FOR T=1 TO 4
7370 IF H(K+Z(T))=26 THEN GOTO 7
400
7380 NEXT T
7390 IF Y<70 THEN GOTO 7310
7395 GOTO 7460
7400 LET H(K+Z(T))=61
7410 LET H(K)=26
7415 LET X=K
7417 LET Y=K+Z(T)
7420 RETURN
7460 PRINT "I CONCEDE"
7470 STOP
8000 PRINT
8010 PRINT "I MOVED FROM ";X;" T
O ";Y
8015 PRINT
8020 PRINT "SCORES: YOU: ";ME,"M
E: ";IT
8040 PRINT
8050 PRINT TAB 8;" 1234567"
8055 PRINT TAB 8;"█████████"
8060 FOR J=70 TO 10 STEP -10
8061 LET A=H(J+1)
8062 LET B=H(J+2)
8063 LET C=H(J+3)
8064 LET D=H(J+4)
8065 LET E=H(J+5)
8066 LET F=H(J+6)
8077 LET G=H(J+7)
8080 PRINT TAB 7;J/10;"█";CHR$ (
A);CHR$ (B);CHR$ (C);CHR$ (D);CH
R$ (E);CHR$ (F);CHR$ (G);"█";J/1
0
8090 NEXT J
8100 PRINT TAB 8;"█████████"
8110 PRINT TAB 8;" 1234567"
8120 IF IT=5 OR ME=5 THEN GOTO 8
140
8130 RETURN
8140 IF IT=5 THEN PRINT "I WIN"
8150 IF ME=5 THEN PRINT "YOU WIN
"
8990 STOP
9000 LET IT=0
9010 LET ME=0
9020 DIM H(99)
9025 DIM Z(4)
9030 FOR A=1 TO 99
9050 IF A>77 OR A=70 OR A=60 OR
A=68 OR A=69 OR A=50 OR A=59 OR
A=58 OR A=40 OR A=49 OR A=48 THE
N GOTO 9090
9055 IF A=30 OR A=38 OR A=39 OR
A=20 OR A=28 OR A=29 OR A<11 THE
N GOTO 9090
9060 LET H(A)=26
9070 IF A=72 OR A=74 OR A=76 OR
A=61 OR A=63 OR A=65 OR A=67 THE
N LET H(A)=61
9080 IF A=21 OR A=23 OR A=25 OR
A=27 OR A=12 OR A=14 OR A=16 THE
N LET H(A)=52
9090 NEXT A
9100 LET Z(1)=-11
9110 LET Z(2)=-9
9120 LET Z(3)=11
9130 LET Z(4)=9
9140 RETURN
```

```
I MOVED FROM 54 TO 36
FROM?
SCORES: YOU: 1  ME: 2
```



(c) Hartnell, 1982









When the ZX-81 was first launched many experts refused to believe it was of any use for business applications. Mike Salem of Hilderbay Ltd set out to prove them wrong

THE SINCLAIR ZX-81 is widely-held to be a toy, not suitable for anything but games and learning to write programs. I will show that is not true at all. The ZX-81, when provided with sufficient memory, can do a wide variety of useful tasks. It is suitable, if provided with good software, for use by people with no previous experience of computing.

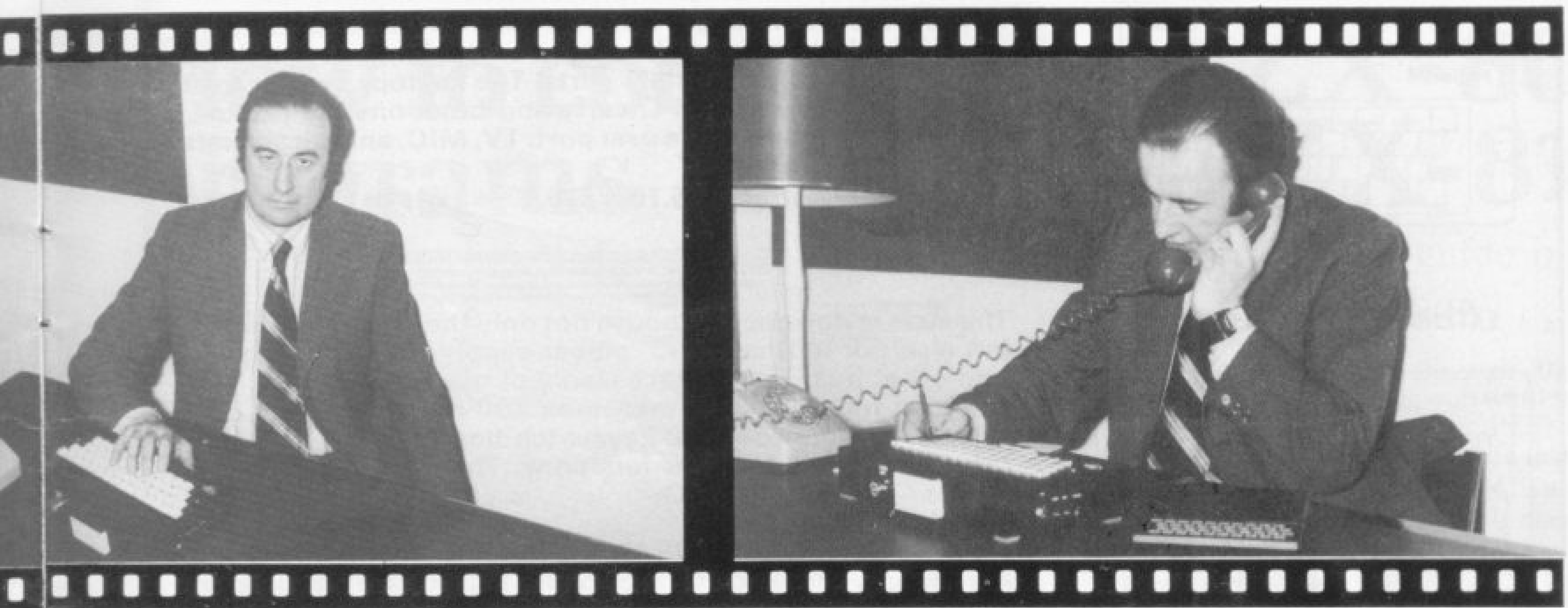
The minimum requirement for serious work is the ZX-81 plus at least 16K of RAM. The printer is extremely useful. A television set and tape recorder must, of course, be used. Such a configuration would have cost many tens of thousands of pounds a few years ago. The price has fallen dramatically but that does not detract from the capability of the machine. The ZX-81 and RAM cost slightly less than £100 plus VAT in January, 1982. Adding the printer and the 48K of memory increases the price to about £210.

The main limitations, compared to other microcomputers, are that the ZX-81 does not support data files, that the printer is rather basic, and that the keyboard is inconvenient to use. Neither can it be expanded except to a limited extent.

Computer memory used to consist of vast arrays of tiny rings of a magnetic material, threaded painstakingly with fine wires. All that had to be done by hand, as it was not possible to design machines to do it. Each ring provided one bit of storage; 16K of core, as it was known, would involve threading two wires through each of about 130,000 rings—with no mistakes.

Computer programs were designed to use core as sparingly as possible. The bulk of the data being processed was stored on relatively simple and inexpensive media such as magnetic tape and, later, disc. Data was loaded into core as and when needed and dumped back to tape as soon as possible.

The ZX-81 does not allow data to be stored on and read from tape by a program—the whole program, with its data, may be loaded and stored later. Even if it were possible to use a data tape in that way, cassette tape is such an inconvenient medium for that kind of process that it would be scarcely practical. So the ZX-81 is



Turning your Sinclair ZX-81 into a business machine

limited, in practical terms, to what it can hold in memory at one time.

How serious is that? It depends on the particular application. Consider, for example, the payroll of a small company. A comprehensive program can be written to fit comfortably within 16K, with nothing omitted; in fact, a feature not to be found in payrolls on much more costly systems can be incorporated —gross pay and deductions can be worked out from the nett pay.

Room is left for full data on 30 employees to be held in RAM; there is no need for data files of any kind.

While that would not be suitable for a large company, it can save a small company doing payroll manually a great deal of unecessary work. Another application is a what-if? type of program; a sheet of inter-dependent data is set up and then the consequences of changes are explored. For example, the effects on company profits of different assumptions about inflation can be assessed.

The width of the printed output is 32 characters; a kind of silver paper is used. The quality of the output is surprisingly good—I was sceptical about the printer until we received one—and it reproduces very well on an office copier. All the information which can be printed on a wider printer can, if necessary, be re-formatted to use the 32-character width.

The ZX printer is not, of course, as good as a printer which costs more than the complete 48K ZX-81 system but it is a matter of inconvenience rather than impossibility. The graphics capability of the ZX printer is good.

The keyboard is perfectly usable, although slow and inconvenient. Keyboards of conventional type can be bought from independent suppliers for exceptionally reasonable prices.

It is very easy to plug disc drives and various interfaces into a computer such as an Apple II. The ZX-81 is very much more difficult to expand and interface. Nonetheless, many people are spending a great deal of effort on the problems and unbelievable products are appearing at unbelievably low prices.

The ZX-81 has a very good version of the Basic language. Numeric information is handled well; text information is handled better than by most machines, including some in the more than £10,000 bracket. The machine is small, light and very robust; 16K of memory goes a long way, as will be seen when discussing possible applications; 48K is unbelievable.

There have been problems with the interconnection between the ZX-81 and the RAM pack—the machine would suddenly go ahead, losing all the contents of memory; those problems can be solved in an entirely satisfactory way. It is perfectly feasible to operate a ZX-81 for 24 hours a day.

The prime advantage is, however, the price.

A ZX-81 with 48K of RAM can do virtually everything that a 48K Apple with printer but without discs can do —but compare the prices.

The price difference extends into the software field—compare the price and performance of a really good ZX-81 program to that of a similar program for a more expensive machine.



How to convert your ZX-80 programs to run on a ZX-81



A step by step guide by
Mark Charlton

LOOK QUICKLY through the listing of a program you want to convert. If there are no PEEKs and POKEs and you have more than 1K on your ZX-81, you are not likely to have many problems. The main difficulties in converting programs occur when there is POKEing to the screen, or when the ZX-80 program proves to be too long for the 1K ZX-81 when converted.

Despite that, most programs will run more smoothly on the ZX-81. PRINT AT and SLOW ensure that far more attractive displays are possible and the use of inverse graphics in PRINT lines can also enhance the display. Using INKEY$ instead of INPUT A$; pressing NEWLINE also makes things work in a much more satisfactory way.

If you look through the program before you enter it and see there are no PEEKs and POKEs, you should make a few changes on the listing before turning-on your computer. Change the way the random numbers are generated, for a start:

```
ZX-80
LET X = RND (10)

ZX-80 LET X = INT (RND*10)+1
```

You may be able to save a line when you see the following in a ZX-80 program:

```
LET X = RND (10)
IF X = 5 THEN PRINT "FIVE"
```

The ZX-81 version could well be IF RND greater than or equal to .9 THEN PRINT "FIVE".

After changing the random numbers—and realising, of course,

(continued on page 44)







(continued from page 43)

that RAND on the ZX-81 is equal to the ZX-80 RANDOMISE—look for any use of TL$ (truncate left) in the ZX-80 program.

The ZX-81 equivalent of this very useful ZX command is A$ (2 TO). That is, if the ZX-80 program says:

```
LET A$="HELLO"
10 LET A$="HELLO"
20 Print A$
30 LET A$=TL$(A$)
40 IF A$ greater than "" THEN GOTO 20
50 PRINT "GOODBYE"
```

You should rewrite it to read:

```
10 LET A$="HELLO"
20 PRINT A$
30 LET A$=A$(2 TO)
40 IF A$ greater than "" THEN GO TO 20
50 PRINT GOODBYE
```

In both cases, the output of the program will be:

```
HELLO
ELLO
LLO
LO
O
GOODBYE
```

The ZX-80 lacks the facility to deal with floating point arithmetic, so it truncates a number automatically. The INT function should be used before any division in a ZX-80 program listing when entering it into the ZX-81. You may find that you would prefer the computer to round the figure to the nearest whole number, rather than to the lower whole number.

Here is a small program on the ZX-81 to show that the INT function does not 'round' to the nearest number but just to the nearest lower whole number:

```
  10 INPUT A
  20 LPRINT A,INT A
  30 GOTO 10
1                1
1.4              1
1.7              1
1.99             1
```

The output shows the numbers entered (1, 1.4, 1.7 and 1.99) and what happened to them. You need to add .5 to the numbers entered if you want rounding-up, as the following example shows, when entering the same initial four values:

```
  10 INPUT A
  20 LPRINT A,
  30 LPRINT INT (A+.5)
  40 GOTO 10
1                1
1.4              1
1.7              2
1.99             2
```

Certain functions on the ZX-81—PRINT AT, PLOT and TAB—'INT' a number automatically, so work out which value—the nearest whole number or the lower whole number—to which you would like them to be INTed.

If you have a program which stores information in and retrieves information from REM statements, you can convert them easily by keeping in mind that the first address after the word REM in the first line of a ZX-80 program is 16427, while the equivalent address on the ZX-81 is 16514. Here is a list, produced by the hard-working ZX-81, of ZX-80 (first) addresses for PEEK/POKE REM work and the equivalent on the ZX-81:

ZX80		ZX81
16426	<->	16513
16427	<->	16514
16428	<->	16515
16429	<->	16516
16430	<->	16517
16431	<->	16518
16432	<->	16519
16433	<->	16520
16434	<->	16521
16435	<->	16522
16436	<->	16523
16437	<->	16524
16438	<->	16525
16439	<->	16526
16440	<->	16527
16441	<->	16528
16442	<->	16529
16443	<->	16530
16444	<->	16531
16445	<->	16532
16446	<->	16533
16447	<->	16534
16448	<->	16535
16449	<->	16536
16450	<->	16537
16451	<->	16538
16452	<->	16539
16453	<->	16540
16454	<->	16541
16455	<->	16542
16456	<->	16543
16457	<->	16544

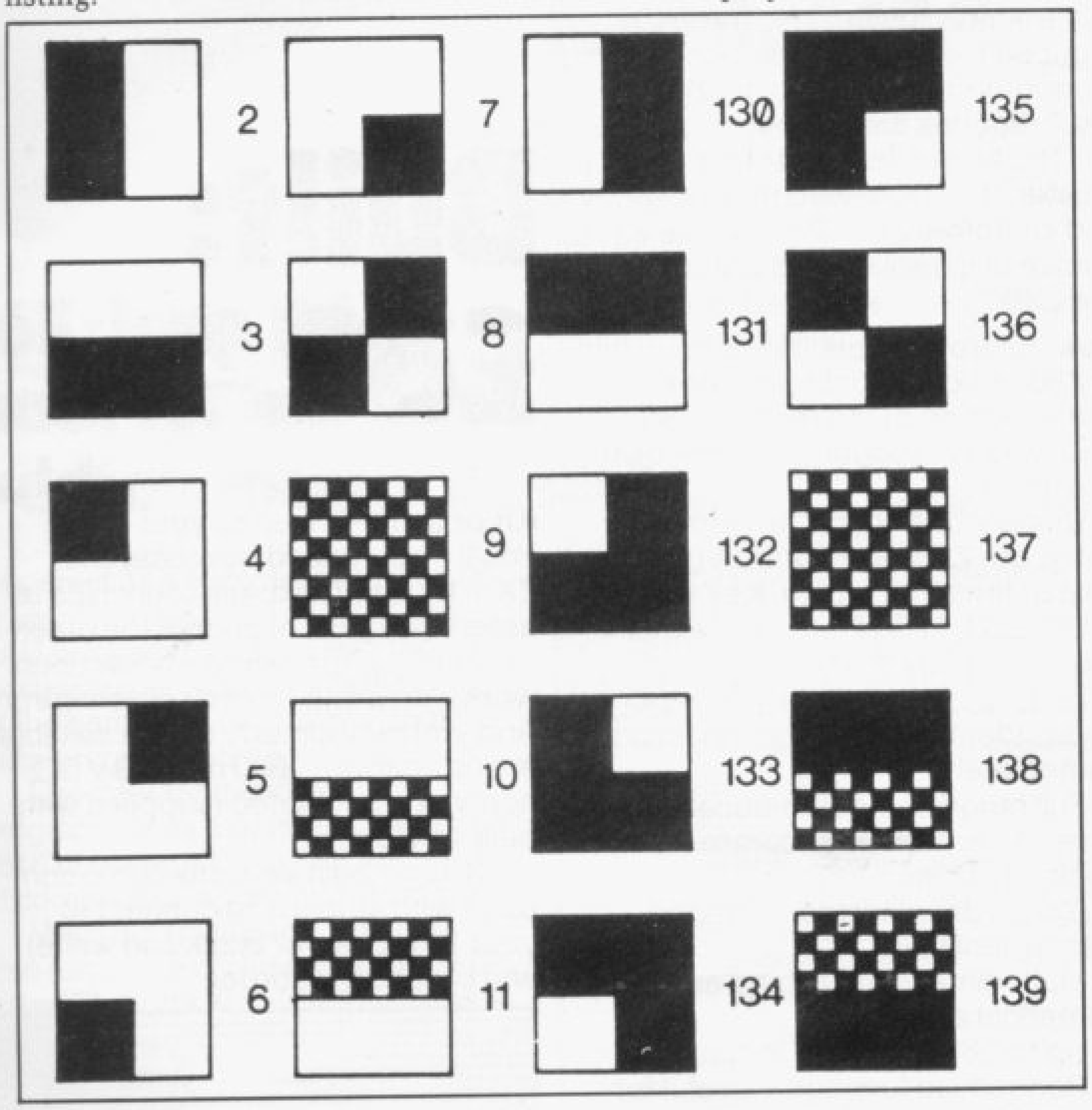
You are probably aware that all graphics symbols, letters and numbers, and their inverses, are available directly from the keyboard on the ZX-81. That was not so on the ZX-80 and, depending on the listing, you will find either a great number of things like PRINT CHR$ (128) to print an inverse space, or that the listing draws-in the required charac-



ter or refers to the graphic on a particular key.

If the specific key is referred to, use this table to convert, keeping in mind that the first reference is to the ZX-80 keyboard, the second to the ZX-81: shift Q, graphic 5; shift W, graphic 6; shift E, graphic 1; shift R, graphic 2; shift T, graphic D; shift A, graphic A; shift S, graphic T; shift D, graphic 4; shift F, graphic 3; shift 6, graphic S.

Here are the graphics symbols available on the ZX-80, with their character numbers and codes. Use this table when you find a reference to, say, PRINT CHR$ (137) in a ZX-80 listing:



You may find that the appearance of the program when running will be greatly improved if you use PRINT AT rather than CLS. Experiment with display formats to see if you can dispense with use of CLS. The SCROLL command is very useful for printout of tables.

ZX-80 programs which use a moving display routine are generally greatly improved on the ZX-81. You will find it necessary to delete the whole of the moving display, changing it to PAUSE—jerky, but the only thing possible on a new-ROM ZX-80, unless you have added a SLOW—or to a delay loop—FOR J = 1 TO 20 NEXT J—or just leaving it as it is. You can obtain some indication as to which figure to place after the word PAUSE by keeping in mind that the figure used in most ZX-80 moving-display routines to POKE 16414 is related inversely to the delay—that is, the larger the number, up to 255, the shorter the time the display is held on the ZX-80.

Many ZX-80 programs use the following line to POKE a character into a specific position on the screen:

```
POKE Y*33 + X + 1 + PEEK (16396) + PEEK (16397)*256, n
```

Wonder of wonders, this still works on the ZX-81 adjusting itself automatically to accommodate changes in programs. Y is the count-down from the top of the screen, X is the count across. You may well prefer to use PRINT AT, which produces more or less the same result. Not all system variables are so convenient. Here is a list of them, showing the ZX-80 and Zx-81 equivalents. The list was compiled by Toni Baker:

Old ROM	New ROM
16384	16384
16385	16385
16386	16391
16387	16392
16388	no equivalent
16389	no equivalent
16390	16394
16391	16395
16392	16400
16393	16401
16394	16404
16395	16405
16396	16396
16397	16397
16398	no equivalent
16399	no equivalent
16400	16412
16401	16413
16402	16418
16403	16419
16404	16420
16405	16408
16406	16409
16407	16427
16408	16428
16409	16429
16410	16432
16411	16433
16412	16434
16413	16435
16414	16436
16415	16437
16416	no equivalent
16417	no equivalent
16418	no equivalent
16419	no equivalent
16420	no equivalent
16421	no equivalent
16422	16406
16423	16407
16424	16509
16425	16510
16426	16513
16427	16514

To sum up, here is what you do:

ZX-80	ZX-81
LET A = RND(9)	LET A = INT(RND*9) + 1
LET A$ = TL$(A$)	LET A$ = A$(2 TO)
Moving graphics: POKE 16414, n	PAUSE 255 – n (very approximate)
Variables	see table
Graphics	see relevant table, two given
LET A = C/B	LET A = INT(C/B) or LET A = INT(C/B + .5)
INPUT A	LET A = CODE (INKEY$) – 28

Good converting.

Sinclair ZX81 Personal Compu
the heart of a system that grows with you.



1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

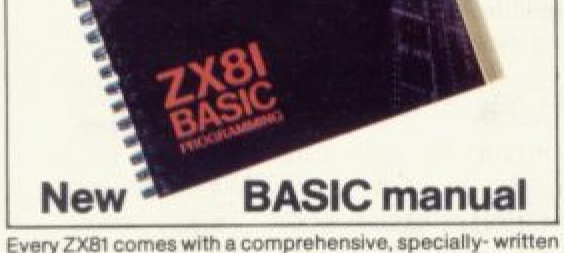
In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability
With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.



New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.95

Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification
- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

Built: £69.95

Kit or built – it's up to you!
You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



uter-



Available now-
the ZX Printer
for only £49.95

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics *and* highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further intructions.

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your computer – using a stackable connector so you *can* plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

How to order your ZX81

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access, Barclaycard or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	49.95	
	Sinclair ZX Printer.	27	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

☐ Please tick if you require a VAT receipt TOTAL £________

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £________

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Starting to get acquainted with the Sinclair book world

Since the dawning of the ZX-80, hundreds of thousands of words have been written about it and its successor. Each month we will examine some of those words to see if they are of value to users. By Ron Coates.

ONCE YOU have your ZX-81, have set it up and worked your way through the manual provided, the obvious question arises—Where do I go from here?

For the Sinclair book, good of its kind, is still only a manufacturer's manual—a guide to the capabilities of the product. It will tell how to do things but is not concerned particularly with why the techniques it describes are useful, nor the best way of attacking a practical program, whether for household accounts or a game.

Do not worry. Publishers are falling over each other to produce books which will aim, with varying degrees of success, to provide the answer for which the new ZX-81 owner is looking.

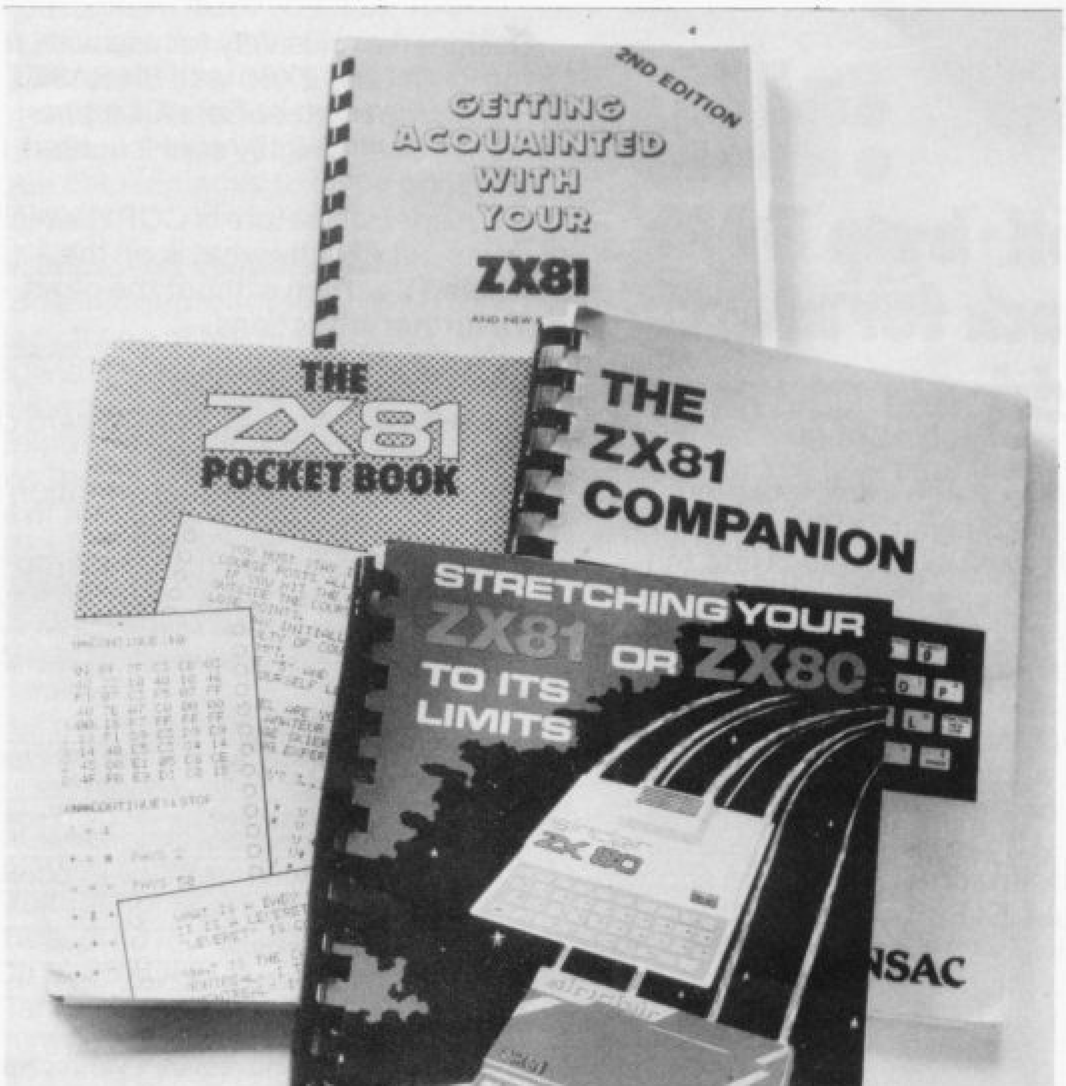
In the U.K. there are at least 15 manuals generally-available for owners of all levels of experience and fields of interest, with new titles appearing almost weekly. That is at least comforting but it raises another problem, that of which to choose. The answer can really be provided by deciding the purpose for which you bought the machine in the first place.

The machine is just a tool. It is how you use it that counts—for enjoyment, for work or for education. The authors and publishers have had somewhat the same problems of trying to decide what information the ZX-81 user might want and how best to impart it.

The approaches generally can be divided into two—that the whole thing should be fun and that the reader should be taught or shown the techniques he needs to know for what he wants to do. Both frequently then leave you to get on with it.

Both are fair enough. The programming techniques learned in computer games are just as applicable to writing a household accounts program as those designed specifically to do so.

We aim to provide a rough guide to the books available, so that you can choose the approach to suit you. All the books assume that the reader has read the manual. Some may say that is not the case but all have to



rely at one point or another on various pieces of information and the explanations in it.

That probably is unavoidable, for if any manual or book tried to explain all its terms and usages in comprehensive detail, it would be long, boring, tedious and, worst of all, very expensive.

The game approach to teaching computer programming has a long history. Many big computer companies and universities discovered that one of the best ways of teaching programming was for the students to design their own games and run them on a machine.

It was regarded by the teachers and students as a painless way of learning how to make the machine work and do what was required of it. When you think that the alternative was to read a number of manuals and then write programs to work out the VAT on any quantity of widgets,



you can see why it became popular; it also worked.

That is the approach followed by one of the pioneer ZX-80 writers, Tim Hartnell, who has a number of titles to his credit of scaled degrees of difficulty. *Getting acquainted with your ZX-81* starts at the lowest level.

It aims to have the reader start using the machine as soon as it can be hooked to the television. The explanatory text is held to a bare minimum, as are the other books. There is a page-and-a-half of introduction and Hartnell then expects you to key-in the first game to see how it works and enjoy it. Then he explains what has happened. Through the book games of greater complexity are listed, most to



demonstrate a programming technique or facility of the machine—tricks with the screen, specialised functions in mathematics and so on.

His other book, *Making the most of your ZX-80* and *Stretching your ZX-81 or ZX-80* are continuations of increasing complexity and I found that stretching referred more to me than it really did to the computer.

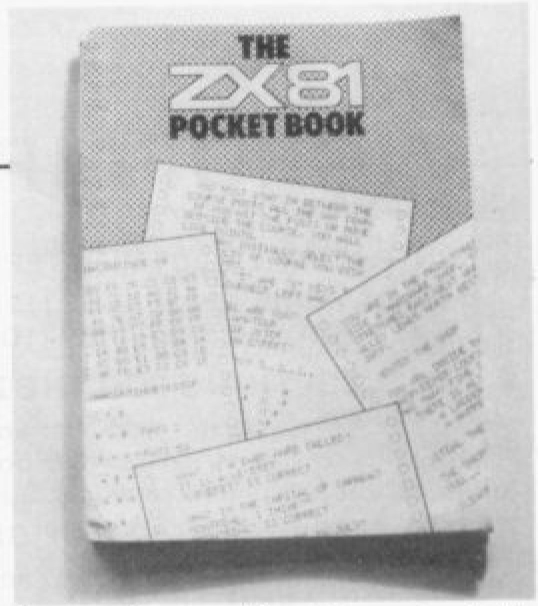
The good point is that Hartnell makes the effort to make learning a pleasure and pushes the reader quickly to a point of confidence in programming ability and the ZX-81.

The techniques and uses of the machine are indicated very well by the example programs. The disadvantages are that the books are all revisions of books for the ZX-80 and Hartnell has had neither the time nor resources to make it clear which listings of programs are for which machine.

His explanations are terse, occasionally to the verge of incomprehensibility, but he never says anything without reason and you can generally grasp the point with a little thought.

That may sound damning but on the whole the books are to be recommended because of the successful effort Hartnell has put into judging the level of information he presents in each.

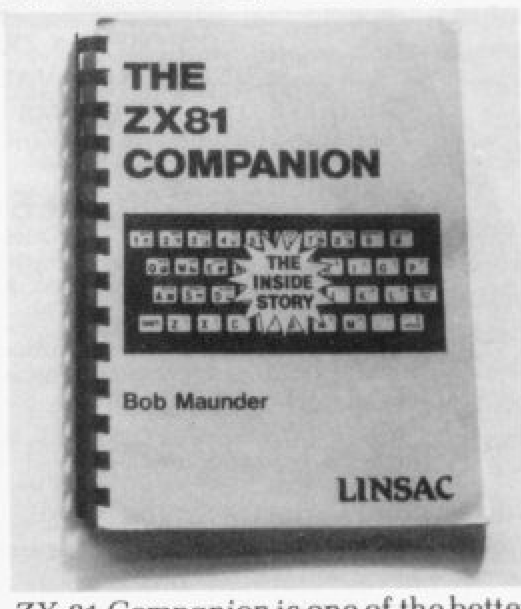
A book which tries to cover much the same ground is *The ZX81 Pocket Book* by Trevor Toms. The author



has made an effort to extend his explanation—for instance each line of programming code is explained if it is novel—and to do more than provide a series of listings to type into the machine.

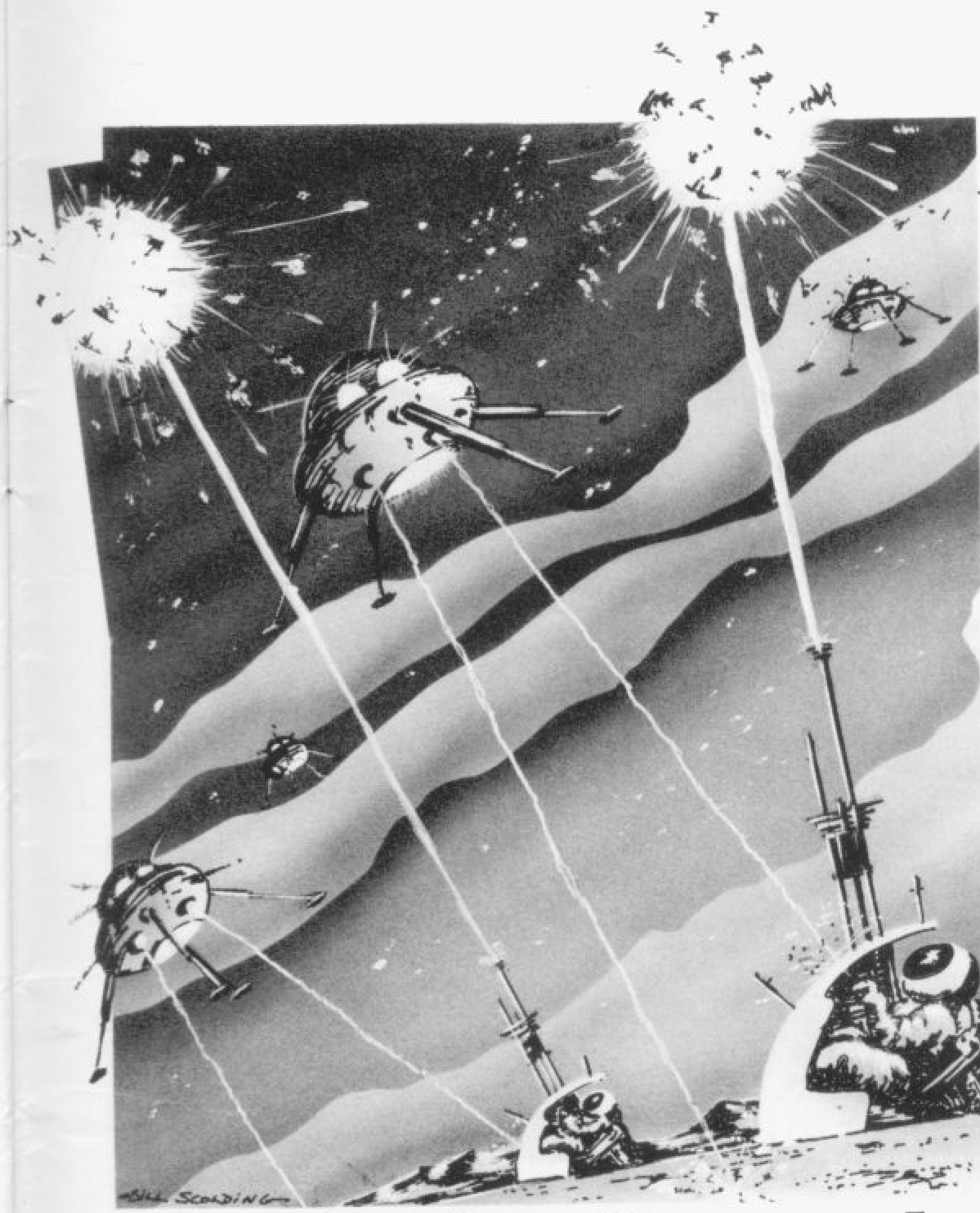
It is not really for the absolute beginner but embraces most of the techniques dealt with by Hartnell's three books. Readers will probably find his explanations easier to follow, because of his step-by-step notation.

For the person who wishes to take the ZX-81 really seriously, *The*



ZX-81 Companion is one of the better books. It is different in concept from the others reviewed. The author is an academic and his style, while not heavy-handed, shows it. Programs and examples are presented clearly but he is obviously addressing himself to the ZX-81 owner who wants to move as quickly as possible from the manual to using the machine for teaching, business or household accounting.

Next month we will look at more serious books and the delightful *Peek, Poke, Byte and Ram.*



Sorting the diamonds from the glass

Phil Garratt scratches the surface of the vast number of products on the market

NO OVERVIEW of software for the Sinclair computers can hope to do more than scratch the surface of an enormous range of products now available. There are many gems among them and one or two which barely make it into the glass category. When my ZX-80 arrived nearly two years ago, it was difficult to find it mentioned in the microcomputer magazines, let alone any software. Now there are hundreds of programs available and almost as many micro magazines.

The earliest ZX-80 offerings were fairly routine—*Mastermind, Simon, Nim.* Ken MacDonald's *Amazing Active Display,* a machine code pause routine, however, showed that there was more to the ZX-80 than met the eye.

Shortly after, the first "flicker-free" games for the ZX-80 appeared, using software in exactly the way that the ZX-81 uses hardware, splitting the Z-80 microprocessor time between keeping on the display and following the program instructions.

MacDonald produced his "flicker-free" if rather eye-numbing *Breakout,* and John Edmonds produced a limited but recognisable *Space Invaders.* He also invented *Galaxy Wars* which, if I had no other reason, is sufficient on its own for me never to want to part with my ZX-80. It is far and away the most original and compulsive game I have either for the 80 or the 81.

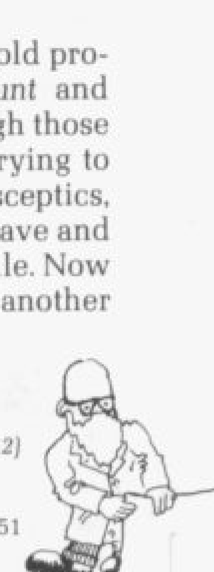
Another major achievement in ZX-80 software was Philip Joy's chess program, which appeared in early 1981. Although its standard of play could perhaps best be described as "not illegal", it showed that the ZX-80 had a potential to match computers costing five times as much.

Then the ZX-81 was announced. By the time the public could obtain either the new machine or the new ROM for the ZX-80, there was already a number of books and programs available, because of the Sinclair "seeding" of some authors with machines. Sinclair introduced a range of inexpensive software, which was good at the time, though fairly routine. Its failure to add to the range in a year is a great pity.

As I indicated initially, all I can do is to try to deal with some of the ZX-81 programs available, which I will split into three groups—arcade games, other games and utilities. I have to omit any discussion of business-orientated packages as they are outside my field but it must be said that Hilderbay, with its range which includes a payroll system, is doing a marvellous public relations job for the rest of us—by showing that the Sinclair is sufficiently powerful to have a serious side.

I am also omitting household programs such as *Bank Account* and *Telephone Directory.* Although those programs are useful when trying to justify a home computer to sceptics, the ZX-81 takes too long to save and load to make them worthwhile. Now if we had discs—but that is another story.

(continued on page 52)





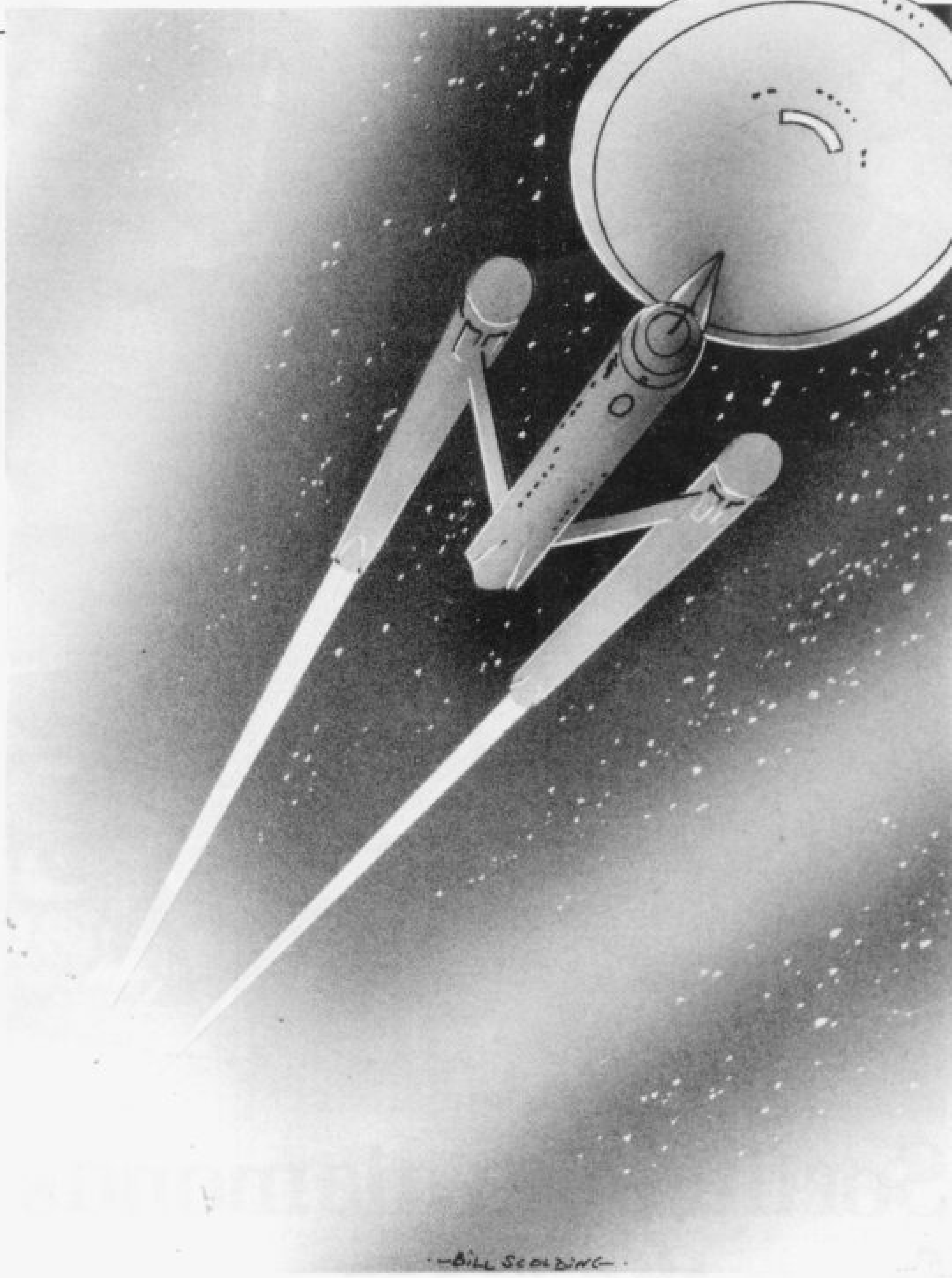
(continued from page 51)

So to arcade games, the most famous of which is *Space Invaders*, and the Macronics version for the 1K ZX-81 is good for the time when your 10 pence pieces run out. Incidentally, Macronics provides a listing with each cassette and it would be pleasant if other companies followed suit.

The program is a smaller version of the real thing—you have only one laser base per game and only the current and last game scores are displayed—i.e., no highest score feature. I had reservations at first but I soon became addicted, as did all the children to whom I showed it at Christmas.

They added their own sound effects of the Pchow! and Wham! variety but if I had had the necessary hardware, that would not have been required for the next two programs, Quicksilva's *Defender* and *Asteroids*. The first involves running a gauntlet of invaders coming at you from the right, while moving your ship up and down, faster and slower, trying to fire while avoiding their missiles and all the time watching the ground rush past below.

The program is remarkable in two respects. First, it includes software to drive an add-on sound generator available from Quicksilva and, although it is not cheap, it adds a new dimension to games. Second, the display uses the entire height of the TV screen—not just the portion of it addressed by the ZX-81.



Asteroids does not use the entire screen but has the sound-generating instructions. Your ship is a number on the screen, which represents the direction of movement or fire, e.g., O equals up, Z equals right, and the like. The larger asteroids disintegrate in a satisfying manner and more and more appear as the game progresses. Once you are used to not having an arrow to show the direction of your ship, it becomes a good game.

The last arcade game at which I look as is DKtronics *Centipede*. I cannot describe it adequately without confusing all and sundry, so suffice to say it has excellent moving graphics and is very-attractively presented, with the game becoming progressively more difficult in several ways.

What is also very creditable about it is that the player can decide at the start how many bases each game should have and how fast the game should run. That means that several people can play at the same level of difficulty and the program produces a high score league table.

Moving to non-arcade games, a number of "adventures" are available and one of the major factors in determining the appeal of an adventure is the number of situations involved in the game. That means that machine code games such as the two Artic Computing *Adventures* have a big advantage over programs using Basic.

The *Adventure A* seems the easier of the two but *Adventure B* will give you a score—if you score anything—although it is much fussier about which words it will accept in each situation.

Both require plenty of time and patience, whereas the Macronic *Nightmare Park* is usually finished quickly. It is really eight or 10 simple Basic programs, such as *Number Guessing* and *Simon*, all joined neatly together, and which you go through at random as you try to cross the

(continued on page 53)





(continued from page 52)
park. This well-presented game kept the children quiet for hours, too.

A number of ZX-81 versions of the classic *Startrek* are available—all, if anything, better than the original mainframe program. I showed the game to an 11-year-old and her comment, "Gee, it takes a million years to kill a single Klingon" is a slight exaggeration, although it is true that a game can take two hours.

I have two versions of the game, one by Macronics, which makes good use of graphics, although entering of commands has to be done carefully, and the other by Silversoft which, although a trifle slower, is better-presented.

Several chess programs exist, although the only one I have is Artic ZX chess. It plays an impressive game on six levels, the first three levels responding in less than 10 seconds, 40 seconds and five minutes respectively. Every level plays good chess but tends to lack an end-game strategy. Recently I have seen the latest version of the program, which has minor bugs corrected, although the input has been made a little more complicated.

In addition, the level one time has been reduced from 10 to two seconds and the others speeded accordingly.

Now for the utilities, which are programs to help you write programs.

The best I have seen is Bug-Bytes ZXAS assembler. It allows you to enter standard Z-80 mnemonic codes, e.g., LD HL. (16396), in REM statements, which are assembled and then placed wherever you want in memory.

It seems that many ZX-81 users are interested in machine code; the assembler makes learning and using it a hundred times easier.

Bug-Bytes also sells a disassembler, which can be used at the same time as ZXAS, and which can produce memories from machine code—e.g., the ROM—plus other facilities. The last program which I have not seen yet is ZX-MC from Picturesque, which apparently allows double-speed loading and saving of any part of the memory, among other things.

I have mentioned fewer programs than I would like and in less detail than I would like. The best thing is to see the programs run before you buy, as more and more are now available in shops. Watch for the 'cowboys' who are selling programs extracted from magazines but, in general, ZX software is good value, often providing displays and routines I would not have thought possible, and cheaper than similar programs for other computers on the market.

Get the m
your Si

Get the most from your Sinclair—or your Atom or Vic-by investing in some of the best books available...

Getting Acquainted with your ZX-81— Tim Hartnell. More than 80 great programs in this 128-page book, including *Zombies, Life, Micro-Mouse, Word Processor* —to use with the printer—and *DRAUGHTS*. This is the number one U.K. ZX-81 book and is designed to get your ZX-81 up and running with worthwhile programs from day one. ZX-81 commands are explained, with programs to show them in action; there is a chapter on how to make the most of the standard 1K memory and much more. *Computing Today* said:

"This book . . . gives you the basis of a hands-on program . . . it is easy to read . . . has something for everyone . . . the practical approach used can only benefit the growing body of users".

In the U.S., *Creative Computing* said: "The book is chock full of games, such as *Checkers*, which draws the entire board on the screen . . . As you work your way through it, your program library will grow along with your understanding of Basic".

Tim Hartnell is head of the National ZX-80 and ZX-81 Users' Club and has used the feedback from hundreds of members to create the most suitable book for the ZX-81 user. **Getting Acquainted with your ZX-81** by Tim Hartnell is £5.95, plus 70p p. & p.

The Gateway Guide to the ZX-81 and ZX-80—Mark Charlton. This 180-page book contains more than 70 fully-documented and explained programs for the ZX-81 and ZX-80. The book is a "doing" book rather than a reading one and the author encourages the reader to try things as he or she goes. *Creative Computing* said:

"The book starts at a low level and assumes the ZX-80 or ZX-81 is the reader's first computer. By the end, the reader will have become quite proficient".

The book describes each function and statement in turn, illustrates it in a demonstration routine or program, and then combines it with previously-discussed material. **The Gateway Guide to the ZX-81 and ZX-80** by Mark Charlton is £6.45, plus 70p p. & p.

Mastering Machine Code on your ZX-81 or ZX-80— Tony Baker.



...or Ato

This great book, the best-selling U.K. volume on the machine code for the ZX-81, has been warmly-welcomed by the computer press and users. *Practical Computing*, in a review on Prestel, said: "Have worked through three chapters so far and it's remarkable. If the rest is as good I expect to be able to do some quite clever things quite soon. It does need concentration but compared to some articles I've read on the same topic its 'Janet and John'".

The book assumes you know Basic, but assumes you know *nothing* about machine code. It starts with well-understood Basic programs. From simple arithmetic and random number generators you are guided slowly through a series of easy-to-understand routines. The book includes an intelligent draughts game, with full display, which fits a 1K ZX-81. **Mastering Machine Code on your ZX-81 or ZX-80** by Tony Baker is £7.50, plus 70p p. & p.

34 Amazing Games for the 1K ZX-81—Alastair Gourlay. This book is the answer to the apparently limited 1K memory provided on the standard ZX-81. Alastair Gourlay, a member of the National ZX-80 and ZX-81 Users' Club from Scotland, has spent a great deal of time stretching the 1K to its limits and the result of that work is in this book for you. The programs have all been dumped

ost out of inclair...



om or Vic

from the printer and are guaranteed to run first time. The programming tricks Alastair has used to compress the programs can be used by you in your programs. The book is much more than a collection of games. It is a guidebook to show you how to make the most of your 1K ZX-81. **34 Amazing Games for the 1K ZX-81** by Alastair Gourlay is £4.95, plus 70p p. & p.

49 Explosive Games for the ZX-81—plus 27 for the ZX-80— edited by Tim Hartnell. In this book you will find many great games to keep you locked to your ZX-81 for hours. The book has listings for every game we thought you might want, including *Galactic Intruders, Breakout, Draughts/Checkers, Star Trek, Death Maze, 4-in-a-row* and an 8K *Adventure*-type program, *Smugglers Bold.* As well, there is a host of new games and adaptations of old favourites.

Many of the programs will run in just 1K, including a simplified *Space Invaders*-type program. Some of the games are based on chance—the dreaded Sinclair random number generator—and others depend on skill, both yours and that of the computer. In editing the book, Tim Hartnell has tried to ensure that each and every program contains at least one programming technique which you will be able to adapt for your programs. **49 Explosive Games for the ZX-81**, edited by Tim Hartnell, is £5.95, plus 70p p. & p.

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Plenty for users

To lead into in-depth analyses of hardware

THERE has been no shortage of developments on the hardware side of the market since the introduction of the ZX-81 in March, 1981. Most were based on designs which developed on the ZX-80 and enhanced by the introduction of the ZX-81. The main differences between the ZX-80—even with the 8K ROM—and the ZX-81 are the appearance of a static screen on the ZX-81—slow mode—and the extension to the expansion bus—the edge connector at the back of the ROM CS line which meant that some of the Sinclair address decoding should be sorted-out externally to the ZX-81.

For the first six months or so, firms were very cautious about the ZX-81, watching the market to see whether it would take off. The first product to appear was a sound board, complete with input/output port and a motherboard from Quicksilva; that was one of the first motherboards for the ZX-81 and meant that the user could have more than just the Sinclair 16K RAM pack on the back.

The next announcements appeared in September, 1981 at the Personal Computer World Show—floppy discs, RS232 serial printer port, cheaper input/output ports and, for the first time, the Sinclair printer. Since then things have snowballed; ZX-81 sales have exceeded the 250,000 mark, showing that there is a great deal of feeling for the micro and the number of firms which have been set up to deal with ZX-81 equipment has more than doubled since September.

The ZX Microfair in November was an event which meant that the equipment which was promised in the glossy advertisements available previously only on mail order could be seen before purchasing. Such was the enthusiasm for that type of Microfair by both the exhibitors—Sinclair alone took more than £8,000 in orders on one day—and the users that another was organised quickly for Janaury.

A word of warning to users—be wary of certain manufacturers who claim that they have a product available when all they are doing is testing the market to see if anyone is interested. It is better to write and confirm on what date they will be able to supply the product to you.

Computer manufacturers have the tendency to quote a date and then supply the product between six and 12 weeks after you have paid. Bigger firms are the main culprits.

I have divided this review of the hardware products available for the ZX-81 into three headings—essential add-ons, keyboards, motherboards and extra RAM. They comprise input and output capabilities where some technical knowledge is assumed; enhancements which require programming skill, but either plug direct into the ZX-81 expansion bus or the ZX-81 is modified by the manufacturer.

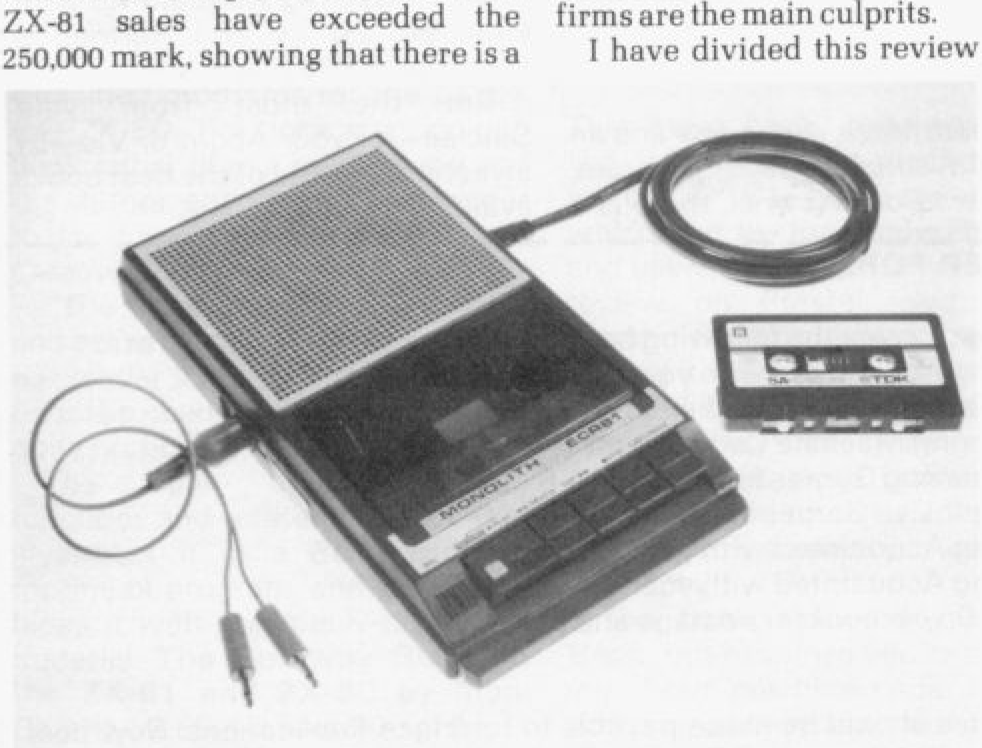
There are two leaders in the amount of RAM you can cram into the ZX-81 memory map. The Memotech 48K RAM pack has the largest continuous Basic memory; not all of it can be used for a Basic program—only the bottom 16K (16K-32K). The rest has to be used for storing data but not machine code.

Audio Computing has the largest memory pack available, 128K of RAM but only 32K of it available at any time. To switch between sets of 32K, called banks of memory, a manual switch has to be thrown and the ZX-81 has to be re-set to start up the Basic system again. That is not very convenient, as it cannot yet be operated from software or the variables transferred from bank to bank.

The Memotech 48K was one of the packs I have tested; it was good value at £129 plus VAT, assembled, and is very easy to use.

So the arrival of Memotech's 64K pack must be welcomed, especially as it retails for only £79 including VAT. More about this newly-released product soon.

There are other external RAM packs varying from an extra 3K giving a total of 4K of RAM to a full 16K of RAM cheaper than Sinclair's. Always check that the RAM pack does not prevent you connecting other equipment after it is fitted to the expansion bus. That was the case with the Sinclair RAM pack, which meant that you had to spend at least £10 to attach anything else to the ZX-81. If you are spending that



A cassette recorder developed for the ZX-81.



s to choose from

e products, Stephen Adams scans the market

money you might as well look at the expansion possibilities after you have it.

The only other RAM extenstion possible is to change the 1K of RAM chips fitted into the basic ZX-81 for a 2K chip. That necessitates going inside the ZX-81 and perhaps some soldering. After checking inside to see if you have one chip—just change the original chip for the new one—or two—a new-28 pin IC socket needs to be fitted—change one strap on the board. Full instructions usually are given with the kits. The new memory chip will cost at least £7 and RAM packs start at £18.

Various keyboards can be obtained which are basically of the same construction, consisting of 40 professional microswitches mounted on to a bare printed circuit board. That replaces the keyboard on the ZX-81. Usually some soldering has to be done. The new keyboard usually is very light to the touch and extremely responsive, improving the time taken to enter a program by at least 50 percent. None of the original keyboard functions are lost as they are all controlled from software.

There is a wide selection of input/output ports available which can provide from 16 to 24 bits of information on a separate bus to the ZX-81 databus. Those outputs are latched; they keep the data the same while the ZX-81 does other things.

They are the only way of getting information in and out of the ZX-81 to control other equipment. They can be divided into two types, memory-mapped—can be PEEKed and POKEd from a Basic program—and input/output-mapped — using special machine-code routines.

Now various attachments can be used on those ports; A/D converters which take a voltage, measure it and give out a digital number for the ZX-81 to read, D/A converters which take a digital number and output a voltage corresponding to it. Light pens can be used to draw on the screen by checking the light received against the screen layout at the time. Most of those require some technical knowledge to be able to use them.

Macronics disc system will act like a super-fast tape recorder using specially-written machine core routines. They will be stored in ROM and can be used to SAVE, LOAD and store random data on 5$\frac{1}{4}$in. disc. The maximum is 40K per disc and the cost is expected to be £249. It also includes the only RS232 printer port available; it will accept data only one bit at a time but many printers are available for it.

There are various attachments to the ZX-81 which, although not essential, can improve the facilities available to the programmer. The newest must be the speech input by William Stuart Systems and the speech output by DCP. That means that you can program the ZX-81 to accept words like LIST, RUN and the like and have it reply in a limited number of words.



Speech input from William Stuart Systems.

Another facility is to have a colour board by Haven Hardware, which is programmable in 16 colours. Programmable character generators can create high-resolution graphics, which can then be printed-out by the very good quality Sinclair printer. Each dot on the screen can be specified, so the resolution can be 512 by 256.

The Sinclair printer uses an aluminium-coated paper with all the characters being shown by black dots. Even without the character board, it can print your own-designed characters but that takes a good deal of memory.

Digital cassette recorders can be bought, designed specially by Monolith for the ZX-81. They are given a registered number and are highly-tuned. If you still want to use your own recorder, Abacus has a cassette switch which will prevent confusion when SAVEing or LOADing.

Motherboards can be plugged easily into the expansion port to give you more sockets, so that all those devices can plug into the ZX-81 all at once.

With all those products it is pleasant to see that one manufacturer, at least, is sufficiently concerned to contact other firms to agree some kind of standard. If you intend to produce something, why not speak to Nick Lambert of Quicksilva?

The final enhancement is more of a service than a product. It is called the Buffer Shop and has been set up in London to cater only for the ZX machines. It is the only retail outlet for products, apart from W H Smith, supplying only the Sinclair ZX-81 and 16K RAM pack.

A greater need for any user is more knowledge about what is available. It is only through co-operation of manufacturers with magazines such as *Sinclair User* that the user of a ZX-81 can make a valid judgement. I can only say that I have done my part and now it is up to you.

ZX81 GAMES

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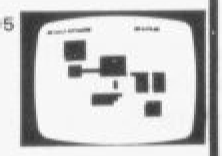
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Ian Stewart & Robin Jones

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Write a program and win a super Sinclair printer

Welcome to Sinclair User and the first in a series of competitions which we hope will help you, the user, make more of your machine. For the next five months we will be giving away a printer—and other special prizes—to whoever submits the best programs for the ZX-81. In this first month, as we want to include all the readers with only 1K of memory, the winner will be whoever submits the best original games program.

Fill in the entry form below and while we will accept a cassette it must be accompanied by a well-typed or beautifully hand-written listing. Your entry must reach us by April 10.

As a tie-break—if one is necessary—we want you to write a slogan beginning with the words: 'My ZX-81 helps me ....'. The usual rules, about the editor's decision being final and employees of ECC Publications being ineligible, apply.

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Complete this slogan which will be used as a tie-break: 'My ZX-81 helps me. . . . . '

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Send your entries to ECC Publications, 30-31 Islington Green, London N1 8BJ to arrive not later than April 10.





April debut planned for prize-winning adaptor

There are more than 20 entries for the £1,000 first prize which goes to the designer of best ZX-81/Prestel adaptor. Roger Green tells the story and why there is a need for the adaptor.

A BRITISH Telecom-endorsed adaptor to allow ZX-81s to run telesoftware programs transmitted by viewdata is to be unveiled at the end of April. The design of the £50 add-on gadget will be the winner of a competition launched at the end of 1981 by Telecom to boost interest among Sinclair users in programs delivered by telephone line through the Prestel viewdata service.

The adaptor is scheduled to make its debut at the April 23-25 Computer Fair in London.

More than 20 competing designs for the unit—which "should be in the spirit of the ZX-81, low-price, practical, robust and efficient"—were entered by the March 14 closing date.

(continued on page 62)





(continued from page 61)

Do not expect, however, to be able to look at Prestel information pages if you buy the adaptor. British Telecom telesoftware product manager Tony Sweet expected that the television display circuitry for that would have to be omitted to keep down costs. He explained:

"What is required is a cheap device which will allow the ZX-81 to load and execute programs stored on the Prestel database".

Viewdata was devised 10 years ago as an inexpensive method of selling to the public information stored at dedicated Telecom computer centres. Users dial the computer from a television set, either with built-in additional circuitry or linked to a special adaptor, and select the information they require by pressing buttons on a calculator-like keypad.

The original idea was to generate out-of-office-hours telephone traffic. As such, the service has so far flopped, so now Telecom is seeking new ways to stimulate demand for Prestel. One way is distributing telesoftware programs to owners of personal computers.

The idea of delivering programs in that way is not new in the mainstream computer world. Personal computer users in the U.S. have for some years enjoyed down-loaded programs obtained from special computer services.

The information transmitted by a Prestel computer is a series of 10-bit binary codes—a start bit, seven data bits, an even parity bit and a stop bit. The viewdata decoder strips-out the data bits which can represent one of 128 display or control characters for the television screen. The display characters include all the usual alphanumerics, some special symbols, and a series of shapes which are used to construct the crude graphics which have become the Prestel trademark.

The display area is treated as 24 rows of 40 character positions. The control codes are used to add attributes to the displayed characters, such as background colour or flashing.

In telesoftware, each seven-bit code can be used to represent an instruction of a microcomputer program. A telesoftware adaptor incorporates some buffer memory and a control program to transform them into executable code which will run when loaded into the ZX-81 RAM. In theory, the transformations could be handled by the ZX-81 but in practice that would take too much memory.

The trickiest problem in the design of the adaptor is likely to be the construction of the modem/line termination unit which links the

(continued on page 63)

Telsoft

(continued from page 62)

device to the telephone network. A viewdata modem employs asymetric transmission format—1,200 bits per second from computer to terminal, 75 bits per second for the human button-pushing in the other direction.

The interface with the telephone line will have to be built to rigorous standards of electrical safety to meet the notoriously-strict Telecom rules.

Telesoftware began with some research by the Independent Television Companies Association as part of its Oracle teletext activities.

Teletext is a close relation of viewdata. Information is delivered to modified television sets in the same format as in viewdata but scrambled into television broadcast signals instead of by telephone lines.

Because there is only so much spare capacity in the television signals, there is a limit of a few hundred to the number of screens of information which can be delivered by a teletext data store. That limitation is the key difference between teletext and viewdata.

The term telesoftware was coined by a consultant, Will Overington, who had the idea of broadcast "software at a distance" in 1976.

The first telesoftware program was transmitted by the Oracle teletext service in February, 1977, for reception on a specially lashed-up Signetics microcomputer system.

The experiments continued later that year with other simple programs, a version of the ubiquitous *Mastermind* game and a calculate-your-repayments mortgage routine.

In parallel, the early demonstrations of what became the Prestel viewdata service included showing some programs initiated from user terminals. Those, too, allowed the calculation of mortgage repayments.

Those early efforts, however, depended on the the viewdata computer doing the work, with only rudimentary data submitted from the dumb terminals.

Although the data processing feature was much talked about in the early days of Prestel, it was dropped quietly as the system was brought into regular service, because it tied up too much computer power.

By May, 1978, however, the idea was gaining ground of telesoftware transmissions by viewdata to intelligent user terminals. The chairman of CAP, a major British computer programming company, predicted confidently that viewdata would become a major vehicle for software distribution.

It seemed then that teletext telesoftware—because it was free to anyone who had the proper equipment—would emerge as the major medium for programs delivered to domestic users. Commercial data processing users, on the other hand, would buy their programs from a viewdata service which was able to charge them for it.

CAP subsequently put some of its own and £90,000 of Government money into developing the concept. In November, 1978, the company had a full-page advertisement in *The Times* to inform a wider world about the innovation and to ask: "Has British management the will to exploit it?"

Evidently British management did not. Outside the world of viewdata research, it seemed that no-one wanted to be told about telesoftware.

The following year, public interest was minimal when, in May, telesoftware emerged as as part of the ambitious plans of the then Labour Government to educate the nation.

Telesoftware was touted as a method of training the unemployed, through intelligent viewdata sets, to design microcomputers and 64K memory chips.

The initiative disappeared as CAP fell into financial difficulties and decided to stay with more bread-and-butter business activities.

At the end of 1979, another attempt was made to promote the cause of teletext telesoftware when the results were revealed of a collaboration between the Oracle engineers and Mullard, the Dutch-owned electronics manufacturer responsible for most of the world's production of the special chips used in teletext and viewdata decoders.

A prototype intelligent television set was demonstrated running telesoftware programs. As usual, there was one to calculate mortgage repayments and the initiative returned to obscurity.

During all that time, a top-level committee, representing all the interested parties, had been deliberating on the design of an intelligent viewdata terminal. All that emerged, however, was disagreement about the version of computer language in which telesoftware should be written.

The most positive and most promising development in viewdata telesoftware occurred in September, 1980 when the Council for Educational Technology published a recommended format for telesoftware programs stored on Prestel.

The move by British Telecom to initiate the development of a ZX-81 adaptor is in parallel with its other attempts to enlist the help of personal computer enthusiasts to bootstrap the telesoftware concept.

The winning adaptor is to be awarded a £1,000 prize and the possibly more generous carrot of freedom to sell the design to the 250,000 other Sinclair U.K. users.

If only a tiny proportion of ZX-81 owners signed for Prestel, it would make a big increase to the number of users. At present it is no more than 15,000, at least one order of magnitude below the estimates made in the optimistic days of the late 1970s.

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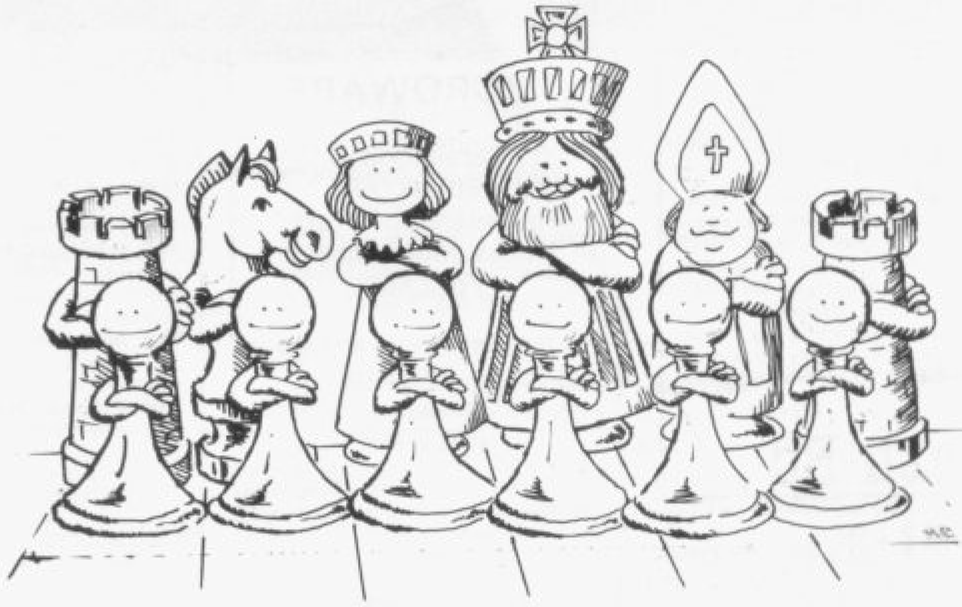
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It's the program that matters if you want the satisfaction of a good game of chess

Philip Joy, who it is generally acknowledged wrote the first worthwhile ZX-80 chess program, begins a series of articles on that game and the many others which stimulate the brain as well as being of immense fun

THERE are now many versions of chess for the ZX-81, which proves how popular the game was. I do not intend to review those versions as that would be unfair, because I wrote a ZX-80 version, but I would like you to send any games you have played with those versions, noting your likes and dislikes. We can compare the versions and see what, if anything, is wrong.

We shall probably notice that the same type of problem appears with all the versions. I can then explain why those problems might exist and you could then reply with your comments.

It is known that a computer cannot play the end game very well; the dedicated chess computers on the market have shown that to be true. I have played against *Chess Challenger* and that shows how well it can play at the start. The production of good openings, by storing standard moves, is a common practice.

Even at the middle game, it shows large amounts of skill. As the game draws to a close, however, the dramatic decrease in skill is noted. The reason is clear; the number of ways in which a game can end makes it very difficult to put standard moves for it into the computer.

If you had a large mainframe computer with its large amount of storage, you could begin to investigate the end game. That has little to do with the dedicated chess machine and even less to do with the ZX-81 but it shows that it is all a matter of storage space.

In a 16K ZX-81 the standard of play is a reflection of the program. The speed of the compactness of program will change only in real terms when you move from Basic to machine code.

The standard of play therefore, I feel, is changed only by how compact the program is. A strong game is a reflection of how compact and therefore how well-written it was. The market for the ZX-81 versions is strong and I would imagine new or updated versions will follow thick and fast.

Keeping in mind what I have said, will an update be so much better? If so, think what must have been done to make it better. If you have one of those updates and you have the old copy, send your views on the update compared to the old version and say whether you think the update is much better than the old one.

In future issues I shall include some of the best letters concerning what I have asked and I will answer them with some reasons why things are as they are. Of course, I hope that some of you are thinking of starting, or are even halfway through your own chess program. You may be interested only in the middle game, or how to obtain the best graphical board; if so, send them. I shall be providing from time to time hints and perhaps portions of my programs.

By what I have asked you to send, we should be able to know everything about the version on the market. I shall hope to include portions of any routines you send, including my own, to provide a set of routines, which may, in the end, produce a chess program.

If that happens, we will all have a chess program built by you, the readers. In the end this page will become a watchdog for chess programs and a library of routines, which I hope could be turned into a working program and printed.

Chess Challenger is copyright by Fidelity Electronics.

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